The Science of Railways

Economical Purchase Care and Use of Material

MARSHALL M. KIRKMAN

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Frontispiece.

THE SCIENCE OF RAILWAYS.

ECONOMICAL PURCHASE, CARE AND USE OF MATERIAL.

DISCIPLINARY AND MORAL QUESTIONS THAT ENTER INTO THE SUBJECT—PRINCIPLES AND METHODS TO BE OBSERVED TO SECURE SATISFACTORY RESULTS—FISCAL METHODS.

WITH ILLUSTRATIONS

OF THE
INCEPTION, GROWTH AND EVOLUTION OF

PRIMITIVE TRANSPORTATION.

BY

MARSHALL M. KIRKMAN.

IN TWELVE VOLUMES — VOL. VII.

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CHAPTER I.

ANCIENT CARRIERS — ORIGIN AND EVOLUTION OF CARRIAGE.

In the Odyssey reference is made to Philætus, the herdsman, who brought heifers and goats to the feast of the suitors by ferrymen who transported in common all who sought passage between the rocky coast of Ithaca and the fertile Isle of Cephallinia. This was twelve hundred years before Christ. It is the first reference, so far as I remember, to Common Carriers. The furtive glimpse we get of these hardy mariners, who at the very dawn of history braved the Ionian Sea in quest of gain, makes us desire to know more about them, their business, its extent, methods, risks, hardships, profits and patrons. How was it controlled? Did crafty Ulysses, or, when he was away, the chaste and prudent Penelope, look after their affairs? Were supervisors appointed to see that they did not charge too much; that they did not discriminate? Or were they left untrammeled? These details, however interesting, we shall never know. Homer's reference is casual; the glimpse he gives us meager in the extreme.

The Ionian boatmen are but a speck on an immeasurable horizon; a link in a vast chain of

men who connect the carriers of today with their progenitors, the people of antiquity, who spake the Aryan language, and who were the authors of our greatness. While the intervening time covers many thousands of years, it is apparent that the descendants of the Aryans possess the same characteristics as their forefathers. The Aryans differed from those about them, just as we do from those about us. Courageous and

Ancient Egyptian Wheel Tire.

warlike, they were also property lovers, at once industrious, thrifty and capable. They knew how to construct, to utilize, to transmit. Their inventions were few and simple, those of children, but contained the germ of useful things. To them, we may believe, occurred the idea of transferring the packs they carried from their own backs to the backs of the brute creation. This was a relief, but far from satisfactory. It

was not adequate. The back of the cow was neither broad enough nor strong enough, and this was the only animal available. The horse had not yet been domesticated. The outcome of their necessities was the wagon.

It is probable that the first vehicle consisted of a roughly hewn plank, drawn on the ground.* Afterward, by combining two or more planks, a sled was formed. Then it is probable the idea of rollers suggested itself. These were the precursors of the cart. This latter was formed wholly of wood, and was exceedingly rude. The axle and wheel consisted of one piece and revolved together. The cart was the precursor of the wagon; its introduction was the first great step in the art of transportation. Its evolution has progressed slowly with the ages. The idea of making the axle and wheel apart was the second great step. No greater discovery has ever been made. Afterward followed the felloe and spoke. The railway carriage of today is thus evolved. We have simply improved upon our forefathers' methods.

Such was the origin of land carriage. That by water was equally simple. Floating driftwood is thought to have suggested a canoe rudely hollowed with fire, afterward with stone implements. A limb served to propel and guide; this

*The Indian vehicle of today consists simply of two poles tied on either side of an animal, or over the shoulders of a woman, the opposite ends trailing on the ground; the paths these primitive savages traverse will not permit of anything more elaborate.

latter was slowly transformed into an oar. The sail followed many ages afterward. In the time of the Phœnicians the rudder had not yet been invented.

The origin and development of carriage was exceedingly slow. Each progressive step, we may reasonably suppose, occupied vast cycles of time. Savages advance slowly; their brains as

Ancient Egyptian Wheel Spoke.

well as their morals must be developed; at first both are merely embryotic. The first step is the difficult one; it suggests reflection, and this in turn precipitates other ideas. Each discovery renders succeeding ones easier.

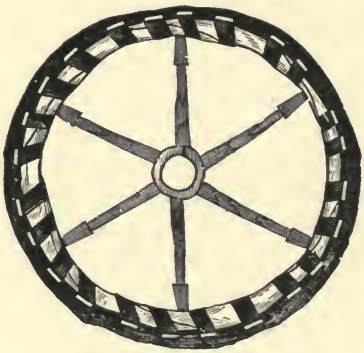
The forms of primitive transportation still in use in various parts of the world point to the simple and gradual evolution of carriage. It is only in Africa, Polynesia and other savage coun-

tries that the human being, the most primitive of all carriers, is still employed. Elsewhere animals have been conquered and trained to work.

Illustrations of primitive transportation evince the general similarity of man's growth. The differences of method also illustrate a characteristic of men, no two of whom ever look, think or act exactly alike. This peculiarity of every assemblage of men has its counterpart in aggregate man. Thus the ideas and methods of particular tribes differ from all other tribes. In all the forms of carriage, by water or land, the devices of no two peoples are exactly alike. Each conforms to some inherent peculiarity or environment of the people who invent it. And so, while we are able to trace the growth of vehicles among the early Aryans, it is probable that they partly borrowed, partly invented. No perfected thing can be claimed as the invention of a particular individual. The suggestion came from some one beyond; its germ was the merit of others.

Where the wagon was first introduced we do not know. The Aryans, however, were familiar with the linch pin, yoke, pole, wheel, axle and nave. They were ignorant, however, of the spoke and felloe; these had not yet been created. They undoubtedly aided in fashioning the wagon, as the word is a part of their language and no reference is found to it elsewhere. This suggests the oft repeated enquiry, who were the Aryans?

Who were the people whose descendants are at once the conquerors and carriers of the world? No one has been able to answer the question satisfactorily. The original home of the Aryan people is still a matter of speculation. It forms an endless theme of dispute. Scholars have placed it in Russia; in Central Europe; on the far off Ganges; amid the high altitudes of Central Asia; in the Mesopotamian valley; on the



Ancient Egyptian Chariot Wheel.

shores of the Baltic. The theorist of today attacks the theorist of yesterday, and with the evolution of each year we commence our journey anew. The discussion is, however, not without advantage. It stimulates interest and inves tigation. Thus through the delvings of archæologists, the deductions of anthropologists and ethnologists, and the discoveries of philologists, stimulated by these differences, we have learned much about the palæolithic, mesolithic and

neolithic man; the brachycephalous (broad headed yellow men), the dolichocephalous (dark long headed men) and the orthocephalous, or intermediate men. The abysmal gulfs that separate us from the early races are thus being abridged. The information imparted to us is oftentimes, indeed generally, defective, but never stinted. We are grateful and not critical.

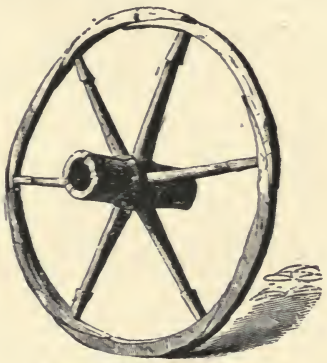
The people of whom traces are first found are ascribed to the palæolithic age. They lived in caves and were contemporaneous with the mammoth, the woolly rhinoceros and other pachyderms: England was at that time connected by land with the continent of Europe. Craniologists assert that the people of that remote age were the progenitors of those who inhabit Europe today; that the dimensions of their skulls were the same.

The implements the Aryans used were those of the Neolithic period. The race is believed to have been brachycephalous,—a tall, powerful, muscular, blonde people. In England it succeeded the dolichocephalous race, a short, feeble, servile, dark race, called Iberians—an Atlantic or Mediterranean people believed to have been the same as the Berbers and Egyptians.

But while much has been accurately determined in regard to the Aryan speaking people, we have learned nothing definite in regard to the home of those who introduced the language.

Except for the circumstance of the separation of the Aryan speaking people, we should know

nothing of the habits of mankind in the Neolithic age. But at that period the Aryans separated, or at least ceased to speak a common language. What is still common to the races who spoke the Aryan language before the separation it is presumed indicates the customs of the people prior to that time. Thus we are afforded a glimpse of prehistoric man exceedingly inter-



Ancient Egyptian Wheel.

esting to those interested in primitive conditions and customs.

It is not probable that all those who spoke the Aryan language belonged to the same race, but that they occupied contiguous territory there is little doubt. The language was the inception of a particular people, and was imposed upon various races or tribes having substantially the same anthropological peculiarities, but differing in their social relations. When the peoples who spake the Aryan language separated, linguistic

peculiarities and environment made themselves felt in their new homes.

It is probable that the Aryan language was more copious than any other of its time. Quite likely it was superimposed upon savages who before possessed only rudimentary forms of speech. If so, it would have been accepted gratefully and without antagonisms. But the particular tribe or race that thus diffused its language can not be identified, nor its home accurately located. It is reasonable to suppose, however, that the favored people who thus dominated their neighbors must have possessed methods and culture, if not bodily vigor, superior to those about them.

While the Aryans are no longer generally believed to have migrated from the high lands of Central Asia, their language is thought to be of Mongolian origin; to have had its germ among the cultivated people of Asia. However, this is only a surmise. The dialects that once connected all who spoke the Aryan language have one by one been extinguished, and the thread which might have served to identify the true Aryan people has thus been lost.

It is claimed by many that the Aryan language was imposed upon many dissimilar tribes. If true, it is singular that all the descendants of these Aryan speaking people so far as we know should have possessed the same exalted attributes,—courage, aggressiveness, executive talent, enormous ability to grow. It has been suggested

that the intrusive yellow, turanian, race introduced the Aryan language only to have been finally subjugated and driven out by the native population. This has been the experience of the yellow race,—to plant the seeds of advanced culture only to succumb afterward to the more aggressive, dominant, white race.

While the Aryans may have been made up of different races, the virility, courage and capacity for development they have displayed in common, evince certain homogeneous qualities of a high order that have made them the dominating race of the world.

Fragment of Ancient Fgyptian Shafts.

The earliest prehistoric man of whom we have any knowledge, as I have already pointed out, belonged to the palæolithic age. His weapons were flakes of stone roughly chipped. This age preceded and attended the glacial epoch which geologists have claimed commenced two hundred and forty thousand years ago and lasted one hundred and sixty thousand years.*

* More or less diversity of opinion exists as to the duration of the glacial period and the time when it occurred. The latter is of great importance as indicating the progress made by mankind since that event, as all the indications denote that man immediately subsequent to that period possessed only rudimentary acquirements and culture. Many astronomers and geologists

The evidences of man's existence during and preceding the glacial epoch are as unmistakable as the imprint of the prehistoric people who worked the copper mines of Lake Superior. The only progress man seems to have made from the palæolithic age to the neolithic epoch was to substitute polished for roughly chipped stone implements and weapons. This was but slight progress and affords no clue to man's prior savage life; to the time that elasped during his evolution from primordial conditions; to the ages that occurred before he learned the use or value of words, the utility of fire, the construction and use of the bow and arrow, clothing, the dugout and wagon. We can not compute the ages that these events occupied or that led up to the arts of plaiting and weaving, the construction of axes and lances, the domestication of the cow, the dog, sheep and goat, the ceremony of marriage and the systematic burial of the dead. Each of these, however, was an invention greater than any discovery of our time because it was the emanation of savages without method or reflective powers,—a genuine inspiration and not the result of ages of evolution and culture such as we enjoy.

Language is the result of similar slow growth. At first a sound oft repeated within the limits of

now set the close of the glacial period no farther back than ten thousand years. If this view is correct, it explains the slight changes in the physique of man and in the flora and fauna of the world since that period. It does not, however, in any way discredit the social evolution of man.

a tribe or clan in connection with some particular phase of savage life became familiar to all, and acquired the force of a well understood signal.* Thus the first word was formed without those who used it being conscious of the fact. It was like the lowing of an ox or the bleating of a sheep. It had, however, a definite meaning. In time it was perfected and beautified by continued usage. Afterward other words, one by one, sprang into existence similarly. Thus from a single gutteral used in a clan or tribe of iso-

Pre-glacial Horses.

lated savages is to be found the root of a copious language. Thus the Aryan language originated; accident, superior capacity or fortunate environment made it more copious than that of surrounding peoples. It may have sprung up and developed while neighboring tribes possessed only rudimentary sounds.

The evolution of man is the same always and everywhere under natural conditions. It progresses rapidly or otherwise according to natural capacity and environment. Language could not have originated in any other way than that de-

* Monkeys use a few such signals.

scribed. It is the natural process. In saying, however, that it arose within a clan or tribe, the meaning is not to be taken too literally. It is possible that before such ethnic divisions occurred among mankind certain rudimentary sounds may have acquired generally the force of words, just as appears to be the case today with monkeys. But these divisions must have occurred early in the history of the human race. Mankind could only have dwelt together in common for a short time, if at all. The antagonisms of savage men and women living together in promiscuity, and the danger that menaced the weaker, forced a separation of men and women into homogeneous tribes almost at the beginning.

If mankind did not spring from a common father and mother, then we may the more readily understand how it came about that there should be different languages. But such an hypothesis is not necessary. The immensity of time that elapsed and the wide dispersion of people that occurred before primary objects were given definite names would permit of the growth of many different languages. But even in the case of a particular tribe speaking a common language, philological changes would commence the moment those who used it no longer lived under the same roof. Afterward, dialectic changes would be interspersed with words borrowed from neighboring peoples. Thus differentiation of languages would arise. But progress in this direction would be slow. So that the time that has

been required for the differentiation of the Aryan language, since the dispersion of those who at one time used it in common, can hardly be overestimated.

The dispersion of the Aryan speaking people is thought to have occurred some time during the Neolithic age, as the objects peculiar to that period conform to those possessed in common by the Aryans, as indicated by their speech. However, the question is not fully determined; year

Carriage in Nineveh.

by year we add something to our knowledge; what the future has in store we can only surmise. We are grateful, however, for any fragment. The immortal race or group that has given the world its greatest impetus, that has developed its highest customs, civilization, government, commerce and trade, claims everywhere and always the love and interest of mankind.

At the time we first catch a glimpse of the Aryan people they were pure savages—a virile, meat eating horde of barbarians. They clothed

themselves in the skins of animals. Their hair was long and unkempt. They did not shave. They were far from cleanly. The sweat that exuded from their bodies kept their skin wholesome if not sweet. They knew no other bath. Their instincts and habits were little above those of common animals. It was long before they learned the art of cooking or the uses of the spit. They did not know how to boil meat. They esteemed the marrow of bones the greatest of dainties. They were Nomads, and pastoral in habit. They lived on the milk and flesh of their herds, the game they killed, and such fruits, nuts and succulent roots as they were able to collect. They computed time, as did later peoples, by the evolutions of the moon. The months had not yet been given names, nor had the day been divided into hours. They had a common name for the night, but none for the day. They were superstitious, as are all savages, and offered up human sacrifices, although domestic animals were also esteemed acceptable. They were great hunters but killed, not as we do for pleasure, but to protect their lives and herds, and to secure food. Hunting became a pastime only when game became scarce.

In the beginning man was dominated by wild animals; as much so as the hare is today. While he viewed the great beasts of prey with apprehension, their prowess caused him to look upon them as superior beings.* He was especially im-

*The fact that primeval man did not claim superiority over the animals is evinced in the fact that in many countries they were worshiped by him.

pressed with things that occurred out of the regular order, such as the fall of a meteoric stone, a shooting star, an eclipse, and kindred phenomena; to each he attached a fictitious importance; in each he had a personal interest. Many ages elapsed before man possessed a weapon with which to combat the beasts that surrounded him.

Assyrian.

A club or a stone was the first that suggested itself. These were the weapons of Hercules.

The original savage was, it is probable, not more civilized or cultured than the chimpanzee. He, however, possessed latent powers denied the latter. Out of his necessities grew the bow and arrow, hammer, axe, sling, knife. All these things were known to the Aryans. They labori-

ously, and little by little, acquired constructive habits. While they used the fur of wild animals for clothing and bedding, they do not seem to have relished their flesh. They did not use fish for food. Cereals were unknown; these followed later in the train of agriculture and the refined tastes it engendered. Where, however, cereals were indigenous to the soil, as millet and wheat in Mesopotamia, they were used.

The implements of the Aryans were of wood, stone, flint and bone; their arrows were tipped with the latter, and they used stone scrapers for removing the hair from hides. Metals were unknown. Man was slow to discover and utilize them. The milk of the cow and goat were equally relished. Horses, pigs, goats and fowls had not been tamed. The art of making butter was unknown, though a species of curd was used that resembled cheese. The Aryans used the fatty substances of milk to smear their hair and anoint their bodies. Whether they were acquainted with the use of salt is doubtful; no reference is found to it in their language. They craved stimulants, and were much given to dissipation. They fermented a liquor from roots, plants and wild fruits; afterward from honey. They knew nothing of beer or wine; the intoxicating effect of the latter was discovered and utilized later. Man has been a drunkard from the start. As a savage he was a hardy, arbitrary, suspicious, tyrannical brute. Countless ages have only served to modify these traits.

The use of clothing was a discovery. It was at first scant and made of the untanned skins of animals—the cow, sheep, pig and goat. The pelt was thrown over the shoulders like a mantle. It was neither sewed nor stitched, but was fastened together with a thorn. The use of the needle and thread was a later discovery. The first needle was made of bone. Hides continued to be used for clothing down to a very late period; when abandoned by the higher classes, they were

Carriage in Ancient Assyria.

still worn by shepherds and slaves. Man early learned the art of tanning. The Aryans knew how to make a species of felt by kneading wool together and pressing it. They had also learned the use and value of flax; it was spun and woven by them. The first manufactured garments were plaited. These garments conformed to the shape of the hides previously worn, just as the utensils of the bronze age took the shape of those of the palæolithic and neolithic ages. It is thought

weaving was first suggested by braiding, and spinning by weaving. Men and women wore similar garments. Tattooing was general. In wrapping their garments about their bodies the fore and upper arm were left bare. This exposure, in the case of women, conduced greatly to matrimonial reflections, just as the practice among the Spartans of exposing their maidens naked on festal days inflamed the marital ardor of the young Lacedæmonians.

The loin cloth was unknown to the Aryans. It was an afterthought and indicative of growing effeminacy. It is believed to have suggested the use of trousers. Primitive man covered his feet and head, when he covered them at all, with untanned skins rendered pliable by manipulation. His ornaments consisted of the bones of enemies, copper trinkets, shells, feathers and similar devices.

Man has been vain from the first. He wore ornaments before he did clothes. The dress of civilized peoples represents their stage of culture. Save the primary purpose of warmth, elaboration denotes progress in taste. While the first object was protection, enormous importance has always attached to ornamentation. Men do not take kindly to civilized dress. The savages that were overcome by the Romans are said to have thrown off the habiliments of their conquerors when no longer in their presence.

The cultivation of dress finds its counterpart in many other things that civilized peoples consider

fundamental. Thus, we attach great importance to our family names. It is wholly a cultivated feeling. Savages and semi-civilized peoples change their names oftentimes more readily than their clothes. Thus, semi-civilized negroes have been known to have as many different names as there are days in the month. When they become civilized, they restrict themselves to one, and this they endeavor to transmit through a long line of descendants. The great diversity of names that

Carriage in Ancient Assyria.

exists is the result of the changes and fancies of semi-barbarians.

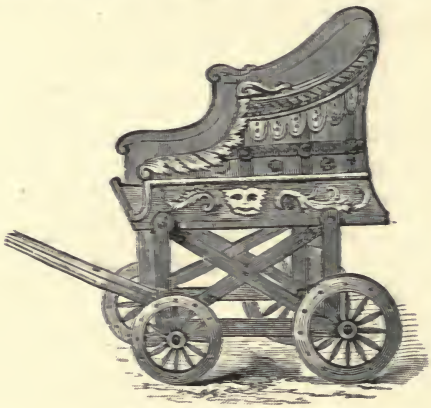
The Aryans understood the art of pottery and the use of the potter's wheel. Like all other primitive people, they were originally troglodytes—cave dwellers; afterward they dug holes in the ground for dwellings, ascending and descending by ladder. Similar shelter was provided for their animals, a shaft or incline being used for ingress and egress. They also constructed rude huts on the ground, made of wood and loam

but more often of wicker work, grass, twigs, rushes and willows. They were round or tent shaped and had doors. Windows and chimneys are inventions of our day. The fire was kindled in the center of the room, the smoke finding an outlet through a hole in the roof or open door. Dwellings were occupied by the inhabitants and domestic animals in common. The Aryans, like many nomadic people, used their wagons for houses. They moved from place to place as interest or inclination prompted.

The only civil institution the Aryans possessed was that of marriage; they acquired their wives by capture (rape) or purchase. Punishment for murder was meted out by the nearest blood relation or the village. Theft was esteemed more serious than murder, as it is among all savage or semi-barbarous peoples, and was punished by death or banishment.

Men appear always to have believed in an overruling providence. The religion of primeval man was based on natural phenomena, which is ascribed to supernatural causes. The religion of the Aryans consisted in the worship of natural objects: the oak, the brook, the mountain, and so on. They believed themselves to have sprung from the earth, the trees, and the rocks. Their religion was of a milder form than that of the ancient people of Shumir and Accad, who may have been their neighbors. It found expression in reverence paid to the sky, dawn, sun, storms, thunder, fire, and so on.

In studying the beginnings of religion, that of the Shumiro-Accades is especially interesting. In their ritual the magic of the soothsayer was necessary to allay the fantastic superstitions that their fears conjured up. A peculiarly religious people, they saw going on about them a never ending contest between good and bad. The rain that benefited them flooded their fields; the sun that gave warmth withered with its heat; the



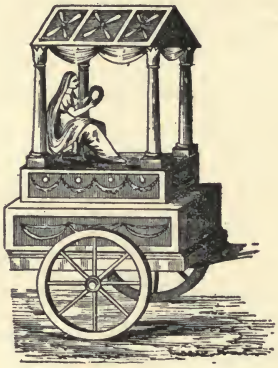
Carriage in Ancient Rome.

wind that tempered the sun's rays uprooted the crops; light and darkness and summer and winter were antagonistic spirits that they endowed with life. They believed that a singular intelligence animated creation. The earthquake, the sun's eclipse, the sighing of the winds, the movement of flying leaves, the flood, the tempest, every incident of life, was fraught with joy or ill omen to them. The clouds that floated across the azure

vault of heaven were to them simply animals feeding on its broad expanse; the trees they believed to be sentient, like themselves; the thunder was the voice of an unknown deity; lightning, a premeditated stroke; the wild animals that preyed upon their flocks, insanity, leprosy, blindness, sickness, death, were to be traced directly to malign influences which, to be warded off, must be propitiated.

They believed themselves to be surrounded by goblins, demons, phantoms, apparitions, ghosts, sorcerers and witches. They attributed fevers, pestilence, earthquakes, floods, barren women, deformed children, family dissentions, to bad spirits. To allay these hosts of evil they employed conjurors, enchanters, magicians and soothsayers. They believed every object to be endowed with the same faculties that they possessed; with intelligence, sense of feeling, the faculty of sight, hearing, good and bad passions. It is probable that all savages have, in a general way, like beliefs. The art of medicine was not known at the time of which I write. The sick and distressed sought relief in the manipulations of conjurors and the manuals of priests. Talismans were worn. In the course of long ages the Chaldeans (the people of Shumir and Accad) came to believe in beneficent spirits as well as in those that were bad. Among the influences that were good they reckoned the sun, moon, planets, heaven, the atmosphere, fire and running water. These were capable of protecting them—through

the intercessions of priests. These latter evolved formulas, intercessions to beneficent spirits and devices for allaying or nullifying the wrath of those that were bad. Thus rituals originated. They were the precursors of the ritual of today, just as the intermediary agents of the Chaldeans, the conjuror, enchanter, magician and soothsayer, were the precursors of our priest.



Carriage in Ancient Rome.

The evolution of religion represents the growth of man's culture, of his understanding, of his desires and their fulfillment. The existence and evolution of religion indicate that it is a vital, living force; that it has a conscious presence and is not based on imaginative fears or beautiful dreams merely. It may be that it has not yet reached its highest development; that we do not yet fully understand it.

The Chaldean peopled the unknown with imaginary monsters; the malign spirits that surrounded him were infinite; the good spirits few. He believed in a future state. He buried with his ancestors their ornaments, food, weapons, clothing. All primitive people do the same. It is a part of their religious belief. The Chaldean, however, differing from other peoples who in their primordial state worship their ancestors, stood in the liveliest apprehension of his forefathers. He believed that, as ghosts, they boded him no good; that they were wholly malignant in their purpose and energy; he was, therefore, at great pains to bury them securely and effectually to forever bar their return to earth.

The multiplicity of superstitions and myths that have grown up about man in the progress of ages he has been at great pains to arrange and classify. This work in primitive times fell to the lot of the magicians, enchanters, conjurors and soothsayers; afterward to the priests. These intermediary agents in their several spheres have been thought to commune directly with the spirits of good; to have power over evil. In olden times they were thought to be able to cure diseases, avert magic, ward off sorcery, stanch wounds and perform other beneficent offices of life. They were the first rulers of mankind. They governed through superstitions and fears. Afterward they associated civic functions with their ecclesiastical duties. They thus became priest-kings. These progressive

steps in needs and culture occupied vast cycles of time. No one can estimate the period. Its culmination is to be found in the religions of our day. We partake of the communion; it is the highest form of adoration of which we have knowledge; primeval man performed a like office by getting drunk. Our offering is idealized, his was literal. He worshipped matter believing it to be intelligent; we have discovered that it is governed by a higher power,—this power we worship.*

Grecian.

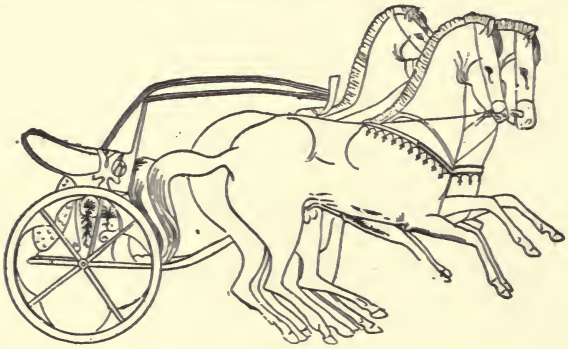
Before the Aryan speaking people separated the family had been created. It more resembled a clan. It was made up of the master, his wives, children and descendants, and collateral relatives and slaves. They formed a community banded together to aid, protect and avenge each other. How far the various clans that constituted the

* The ancient religion I have sketched was that of the people of the Mesopotamian valley. The religion of the Aryans was more simple and plastic; we are less familiar with its details. It was, however, that of savages, and differed, it is probable, only in *minutiæ* from that of the Chaldeans.

community were able to unite for common ends is not known. It is probable, however, that their relations were very slight. This is indicated by their separation and subsequent history. It was as clans, rather than tribes, that they are thought to have parted. The clans that finally made up the Greek nation never had anything in common with each other except their religion, language and traditions.

The family relations of the Aryan people were those of savages; they had, however, passed the period of promiscuity. They were more or less polygamous. Property was recognized in portable things. The land, however, was held in common. Slavery existed. Wives were drudges, servants of the master. It was her value in this direction that first suggested marriage—partly this and partly man's desire to own exclusively. This last desire has animated him throughout his existence. Promiscuous intercourse being a normal condition, man in his primordial state did not seek woman to satisfy merely animal desires. He sought her as property, just as the groceryman seeks a horse to distribute his wares, or the breeder buys a mare to increase his herd. Among the Aryans she was not called wife, but the breeder of children. His title was that of housemaster, ruler; a person to be obeyed. He got his wife by purchase or capture. More or less ceremony attended the nuptials. She abandoned her family when she came to him. The number of wives a man might have was

limited only by his ability to support and defend. Whenever he needed another servant to look after his house, or his riches permitted, he married another wife. His wives and children constituted his wealth as much as his flocks. If a wife was unable to bear children, he was at liberty to put her away; or if the fault was his, he could choose some one to act for him. The act of substitution was not considered disgraceful; it was analogous to a farmer in our



Libyan.

time borrowing seed corn of a neighbor. This illustrates the real status of woman. She was simply a servant and breeder of men. At the time of which I write wives held promiscuous intercourse with their husband's relatives, but outside of this, adultery was punishable with death. Not because it was wrong, but because it was an infringement of the husband's property rights. The difference between the position of a wife and that of a common slave was very slight.

The primitive relations of man and wife among the Aryans continued into historic times; they prevail today substantially in all barbarous countries. The father had the right to expose his child or put it to death. The privilege was rarely exercised in the case of sons, but frequently in the case of daughters. The latter were looked upon as incumbrances just as they are today in China, where it is a common practice to expose them by the wayside to die. Moreover, the destruction of girls rendered those who remained more valuable; husbands were compelled to pay higher prices; the fathers got more. Women do not seem to have viewed the custom with abhorrence; the greater the price, the greater the honor. To be given away was the greatest social degradation that could befall woman.

In all primitive societies the husband possesses power of life and death over his wife. The custom of putting the wife to death with other attendants when the husband dies is frequent. It is not, however, so much a superstition, not so much a desire to furnish him companions on his lonely journey, as to secure his safety while on earth.

While promiscuity was not general among the Aryans, it was sufficient to preclude identification of parents except on the mother's side. Men therefore traced their relationship through the latter. Like all savages, the children regarded their parents with little affection; their love was cold, as with animals, and when their

parents grew old they viewed them as an incumbrance, something to be got out of the way, so that their property might be enjoyed and expense of maintenance avoided. They called them "the old ones," and the custom of killing

Carriage in Japan.

them was more or less general and continued down to historic times.

In the first instance man divided the year into two periods, summer and winter—the seasons of warmth and cold. More minute divisions of

time were regulated by the moon's evolutions. He esteemed the moon more highly than the sun because it lit up the night—the night which brought so many dangers, real and imaginary. This was one reason why he esteemed fire so highly. It kept off the wild beasts, the evil spirits, exposed the machinations of robbers. He spoke of nights rather than days. The Greek day commenced at sunset; the Roman at midnight.*

In primeval times men respected only the lives and interests of those who belonged to their own tribe; all others were enemies, to be robbed, enslaved or killed, as opportunity offered. An exception, however, was made in the case of beggars and suppliants. These were thought to be protected by the gods and were, consequently, highly esteemed. Christianity first taught men universal charity, tolerance and brotherly love.

When men had progressed in the art of government and their wants had become more general, neighboring tribes mitigated somewhat their savage relations. The truce was not, however, based on the idea that robbery and murder were wrong, or that peace was, in itself, desirable. But continual warfare was inconvenient and its results doubtful. Moreover, it rendered exchanges impossible. From the first man has had the disposition of a trader. This disposition

* The custom of the Romans in this respect, also in respect to their division of the year, was gradually adopted by the civilized world.

grows out of his desire to better himself. His ventures were at first restricted to his own clan or tribe. Outside of this they were conducted under the most embarrassing circumstances; to better facilitate them, influential men belonging to alien tribes, and therefore enemies, were sometimes accustomed to visit at each other's hearths and exchange their wares. Visitors under such circumstances were held sacred. Acquaintances thus formed were termed "guest friendships." Friendship, however, had nothing to do with it, although friendships grew out of the custom. It was purely a matter of barter; give and take, as cold and calculating as the visit of a commercial agent of our own time, only more infrequent. The conditions that attached to such visits were that they should be attended with an exchange of presents,—wares mutually desired,—swords, shields, battle axes, bows, arrows, caldrons, tripods, etc. In this way intercourse between men of different tribes was first brought about. It was based on trade. The kind of barter described has been attributed to the Phœnicians, but it was probably of earlier origin.

In later times trade was facilitated by "dumb barter." One party would spread out their wares, say on the sea shore or river bank, and retire, building a great fire meanwhile to attract the attention of the natives. The latter would then come forward and spread out what they were willing to give in exchange, after which they would fall back. If, on returning, the first party

were satisfied, they took what was offered and went their way; if not, they retired to give the other party further opportunity to increase their offer. Good faith was observed; credit then as now rested on this. Thus commerce originated. The next step was the institution of the fair. Hostile people met under a truce at some place previously agreed upon, for a certain number of days, to exhibit their wares and make exchanges.

Carriage in Egypt, 1800 B. C.

The first market was thus established. Its trade corresponded to our imports and exports. Henceforward man's progress was comparatively easy. Men combined to further their aims as traders; wherever these combinations have been frustrated, civilization has waned and mankind has suffered.

Money was unknown to primeval man. Trade was carried on by barter,—give and take. The seller in every transaction was also a buyer. To

a people of the pastoral habits of the Aryans, the cow was the unit of value. With the lapse of time and change of habitation and mode of life, it gave place to other standards; the pig, camel, ass, mule, goat, horse, and so on.* The utilization of metals for purposes of exchange is comparatively recent. Gold has existed from prehistoric times, but was not known to the Aryans. Silver is of later origin, but still prehistoric. It was more highly esteemed than gold owing to the limited facilities of the ancients for procuring it, just as iron, in its turn, was more highly prized than silver for a similar reason. Iron dates from the earliest historic period. The manufacture of steel (tempered iron) was early acquired. Bronze (the product of copper and tin) is supposed to have antedated iron. It is believed that the Chaldeans first diffused the knowledge of working metals. Certainly the art seems to have been familiar to them long before we discover any trace of it in connection with the people who lived to the westward.

When metals came to be used as a basis of exchange, they were weighed in bulk, as iron and

* All debts, fines and obligations of every name and nature were settled in currency of this kind, or by enforced labor. The evolution of mankind in this respect has not been peculiar to any race, people or time. It is a stage in the progress of man. A proof of this is found, if further proof were needed, in the fact that the Imperial Geographical Society of Russia reports, in the year 1893, the existence of a race of people, called the Chewsures, in the Empire of Russia, who at this day know nothing of money. Their unit of valuation is the cow; they value a horse at three cows; a stallion at six, and so on.

sugar are today. Later specific quantities were manufactured into ingots and stamped with their weight. This stamp, naturally enough, took the shape of some domestic animal with which the people were familiar, such as the ox, bull, sheep, and so on. Thus a bar of copper stamped with the image of a cow possessed a value equal to that of the cow. Later the stamp of the government or reigning monarch was substituted. It indicated the value of the token. Copper was the first metal known. The utilization of gold and silver as a circulating medium followed copper. The latter metal was known from a very early date. The Aryans were familiar with it, but seem to have made but slight use of it. The early Greeks possessed the art of hardening copper so as to make it available for swords, spears, axes, etc.

The community of interest that existed among the Aryans in regard to land arose not from choice, but necessity. Moreover, land had little or no value owing to the limited resources of the people and the absence of agriculture. The spirit of modern communism did not suggest it. Men have never accepted partnership with their fellows willingly. A contrary disposition has always indicated man's decadence, his loss of courage, energy, abstinence, independence.

The Aryans were peculiarly ingenious for a primitive people; they had a decimal system running up to a hundred; they counted upon their fingers; a foot, span, arm, or pace was their

means of measuring. These divisions remain with us today.

Simple and primitive as were their customs, they found it necessary to transport articles back and forth to meet the wants of the community. They accordingly had fixed places for crossing rivers and mountains. The latter were a much greater impediment to them than the former.

Carriage in Bengal.

In primitive times a chain of mountains oftentimes stayed the progress of a race for many generations. The necessities of traffic among the Aryan people required means of transportation. This want crystallized, as we have seen, in the wagon. It was drawn by cattle. The horse was still untamed, and the mule did not exist. The latter is said to have been first bred on the southern shores of the Pontus (Black Sea). The

use of the wagon as a house, while a convenience, tended to perpetuate the nomadic habits of the Aryan people because of the facility with which they were able to move from place to place. It weakened their love of locality; they did not stay long enough in a place to become attached to it.

The ox and the cow served the Aryans for food and as carriers. It is because they were not familiar with the horse that scholars hold that they could not have come, as at first supposed, from the table lands of Asia, where the horse was indigenous. It was in Asia, the land of the rising sun, of mystery and romance, that the horse was first domesticated. Evidences of his presence in Europe, however, are found during the palæolithic age, where he was used for food. He appears not to have been larger than a Shetland pony. He had, however, enormous teeth and jaws. His development is the result of breeding. He was used by the Greeks for drawing their war chariots, and was thus employed at the siege of Troy. But they had not yet learned to mount him. The fable of the Centaur—half horse, half man—is said to have grown out of a belief upon the part of those who saw a man on horseback for the first time that the horse and rider were one. The Egyptians, rich, luxurious, worldly wise, had no knowledge of the horse in early times. The builders of the pyramids, who, above all sovereigns, exercised arbitrary sway over men, did not even possess so simple a lux-

Carriage in Zanzibar.

ury as a palanquin. It is probable that the conquest of Mexico by Cortez would not have been effected except for the superstition the natives attached to the horses of the conqueror. The animal was unknown to them.

The horse has ever been the favorite Carrier of mankind. The Grecians loved horses as we do. They bred them with the utmost care. Upon their fleetness, intelligence and strength their lives oftentimes depended. Chariot racing was a favorite amusement with the Greeks. Two, three or four horses were hitched loosely abreast; victory depended upon their swiftness and the skill and courage of the driver. To be victorious at Olympia was the greatest honor that man could attain. The races occurred every four years; this year was called the Olympiad.* King and noble, priest and layman, alike competed. After the decadence of Greece, the races were perpetuated by the Romans. The strife that these contests gave rise to greatly stimulated the improvement of horses. This improvement is still going on. Horses of superior breed were revered by the ancients. Those of Achilles were said, because of this, to have sprung from the gods. History abounds with the quaint superstitions of primitive people regarding this animal. Bellerophon, King of Lycia, it was said, sought to mount the skies on his steed Pegasus The nomad looks upon his

* The Greeks measured time from the first Olympiad seven hundred and seventy-six years before our era, just as we compute it from the birth of Christ.

horse as his friend. The Asiatics make him their companion. Among the highly capable races, the semitic peoples seem to care least for the horse.

The idea of using the horse was an incident in the evolution of man. Running wild over the vast steppes of Central Asia, he was caught and tamed. Broken, he became effective for war.

Carriage in Burmah.

Chivalrous Greece attached an exaggerated value to him, but the roughness of the country prevented his being generally used. At the battle of Marathon (490 B. C.) the Greeks had no cavalry; a runner carried the news to Athens. In the retreat of the ten thousand (400 B. C.) Xenophon had no cavalry, except such as he was able to organize from the pack horses and those cap-

tured from the Persians. In Greece, Elis and Thessaly, with their verdant valleys and grassy slopes, were the favorite breeding places for horses. However, all the horses raised annually in Greece did not equal those bred by Tritæchmes, Cyrus' governor of Babylon, who owned eight hundred stallions and sixteen thousand mares, besides the annual war contingent he furnished the government.

The Arab, of all men, possesses the greatest affection for his horse. The Scythians, a savage, untamable race, used the milk of their mares for food. The Parthians, the most formidable horsemen of whom we have any account, did likewise. Before these fierce warriors the legions of Rome, hitherto invincible, succumbed. The Thessalian horsemen were the most famous of Greece. Siding with Xerxes, they afforded him effective aid in his invasion. The phalanx of Philip of Macedon, supplemented by the Thessalian horse, made him invincible. Nothing could withstand their onslaught. In the battle for supremacy between Sparta and Thebes, at Leuctra, the former had one thousand horse, while Epaminondas had a less number; in the final struggle at Mantinea the Thebans had three thousand horse, the Spartans two thousand.

The stealing of horses and cattle in primitive ages was a favorite means of robbery, as it is now in all new countries. It was punished with death, as it is today on the frontiers of North America. From being at first merely a source of delight or

Carriage in Cairo.

an instrument of war, the horse became more and more, with the lapse of time, a drudge, a vulgar carrier of packs, a drawer of water, a hewer of wood, so to speak. Of all nature's gifts to man, none exceeds the horse in value. His strength represents the unit of our service. He is the real progenitor of the steam locomotive. But with its advent his value to us has not been lessened. From the earliest ages he has been the mainstay, the pillar of strength of Carriers.

A study of the Aryan speaking people carries us, step by step, down to those among their descendants who first achieved greatness—the people whom we most love, the Greeks, among whom we discover the first Common Carrier. The petty kingdoms of Greece were evolved from different clans, generally similar to each other, but never sufficiently close to become cemented or to prevent intense jealousies and hatreds. The first glimpse we have of them is at the siege of Troy, where contingents from every part of Greece were assembled. Troy was the seat of power on the Asiatic coast; the center of vast political machinations that kept Greece in constant alarm. The rape of Helen was, it is probable, the ravishing of the Grecian coast by its marauding subjects. It is not now believed that the Greeks would have gone to war for a wanton like Helen. They were too practical; too thrifty. The war grew out of the predatory raids of the Trojans. Driven, finally, to despair, the Greeks collected their forces and sailed away to the

Carriage in Georgia (Valley of Caucasus).

coast of Asia Minor, where they waged a desultory war against their enemies for many years. The siege was only an incident—the culminating one. At that time the Greeks were hardly more civilized than the savage Indians of North America. Indeed, no primitive people so greatly resemble the Greeks of Homer as some of the North American tribes.

The Greeks lived on meat and were much given to fighting and drunkenness. The funeral rites of their great chiefs were holocausts of blood; hecatombs of slaves and prisoners were slain to appease their manes. In other cases animals were generally used for sacrificial purposes. At the time of the Trojan war the great kings of Greece lived apart in impregnable fortresses. The walls of some of these were of enormous thickness; those of Tiryns and Mycene were from twenty-five to fifty feet thick, and proportionately high. They indicate the necessity there was for defence. The floors of the living rooms in those citadels were of concrete, roughly patterned in squares and painted. The walls were coated with plaster and decorated with delsartian animals and figures, a rude panel following the ceiling in some cases. The fireplace, as in the case of all primitive dwellings, was in the center of the room. Cleanliness was not a virtue with the Greeks more than with other semi-barbarians. The filth and stench of their dwellings would be intolerable to a civilized person. The security of their fortresses required that they

should understand and practice drainage, but there was no thought of sanitation or ventilation. Great numbers of people ate, lived and slept in the same room; the animals they required for food or for sacrificial purposes were

Carriage in Holland.

killed and dressed in the room where they were to be cooked or at the door without. The entrails were devoured by dogs, or lay festering in the air. It is not probable that the palace of Priam equaled in comforts the hut of the poorest Russian peasant.

In the tombs of the Grecian kings of that age Doctor Schliemann found vases, bowls and jugs made of clay, painted and varnished; also terra-cotta idols, fashioned after the image of man, but so rude as to be hardly recognizable. The dead were embalmed. Slabs, rudely decorated with hunting scenes, marked the graves. With the bodies were found the ornaments that adorned them when alive—diadems, pendants, crosses, earrings, bracelets and rings of hammered gold in *repousse* work; gold hairpins; glass and amber beads; gold, silver and copper cups and images; spear heads, swords and knives of bronze; stone and obsidian arrow heads. The people were idolators. However, they believed, like their ancestors, in a future state. The period was known as the Mycenean age, 1200 B. C. Its civilization was utterly destroyed a hundred years afterward by the Dorian invasion. But so great was the genius and versatility of the Greek people that in the time of Pericles, four hundred and fifty years before the Christian era, the descendants of the semi-savages of Mycene had become a highly cultivated people, the equals of the greatest teachers, statesmen, orators, sculptors, architects, poets and warriors the world has ever known.

The first glimpse we have of the Grecians they are clothed in the skins of animals. Their weapon is a club. A sharp stick, hardened in the fire, serves as a spear. They live upon the semi-raw flesh of animals. In Arcadia the acorn served

for food. Robbery was common. The peculiar situation of Greece, projecting like an arm into the sea, made her people pirates, and for many centuries kept them pirates. Thus they grew up adventurous and independent. They were vain to the last degree, like all talented people. In

Carriage in Servia.

their early history the Greeks gave but little thought to the arts of Carriers. Their highways were poor and infested with robbers. They were a contentious, pugnacious race, at constant variance with each other. They loved war, but with the prudence of those who value property, abstained from burning each other's cities. Herein

they differed from all other peoples. When, however, at war with other nations (whom they classed indiscriminately as barbarians) they destroyed what they could not carry off, murdering or enslaving the inhabitants without mercy. The Greeks were at once crafty and unscrupulous; refined and brutal, artistic and sensual, wise beyond all other men. Prize fighting was one of their favorite amusements. The hands and lower arms were encased in leathern thongs loaded with lead. Prizes were awarded as they are today. In the fabulous encounter between Hercules and Eryax the prize was said to be the kingdom of Sicily; Ulysses fought Irus for the right to solicit alms; in the contest between Epeus and Euryalus, at the funeral of Patroclus, it was a mule and a bowl; in the contest between Entellus and Dares at Drapanum it was a bullock, and in the account Dares is described as being carried off the field gulping up blood and teeth. The encounters were oftentimes fatal, but were conducted by the Greeks with less brutality than was the custom with surrounding nations.

Greece abounded with vast forests and impassable morasses. The Greeks cared little for travel. They associated the power and mysteries of the gods with the mountain heights,—hence the Olympian Court, Idean Jove. Unfamiliar with the geography of the earth and ignorant of its laws, they filled its unknown places with creatures of their fancy. When perplexed, they visited the shrines of the gods for advice, poring

over the delphic utterances they received afterwards with incredible patience and childlike faith. Ambitious, fierce, warlike, they treasured their personal liberty above everything else. They were like the Aryans, extremely superstitious. To them the wind and the rain, the sky and the cloud, the wood and the river, were living things. They heard the voice of Jove in

Carriage in Belgrade.

the thunder; saw his arm in the lightning. They peopled the water with deities, nereids, sea nymphs; the islands with cyclopean monsters, cannibals, satyrs, furies, syrenes, enchantresses, harpies; the gloomy forests with gods and satyrs; the borders of the earth with creatures half human, half animal. The winds and the storms they believed to be stored in vast caves ready to be let loose.

The Greek religion is thought to have been derived from the Egyptians and Chaldeans. It was simple and unquestioning,—that of children without a past who knew nothing of natural laws. They believed that everything depended upon the personal interest and inclinations of the gods, who aided those they loved and thwarted those they disliked. They picture the gods as coming and going at pleasure, sometimes making their presence known, but more often not; to their visitations and amours were due the half divine heroes of Greece,—children of gods by favored men or women out of wedlock. They attributed to the gods the same passions as men, only of heroic character.

The ships of the primitive Greeks were small, ill constructed and cumbersome, little better than open boats. When ashore they were drawn up on the land, as the Indian does his canoe. At such times the masts and other paraphernalia were removed. Virgil speaks of the vessels of Æneas as having anchors, but in this he is thought to have erred, the anchor having been invented later. Vessels were without cabins; commander, sailor and guest alike slept upon a bench. The compass was unknown; at night the moon and stars served as guides; adverse winds and storms were ascribed to an offended deity; favorable winds and clear skies were construed as the friendly countenance of a kindly spirit.

The early Greeks were migratory. When overcrowded or molested they moved away,

forming new settlements; right of selection was recognized as belonging to the strongest; there was no security, except such as was maintained by force; men were hunters and shepherds, but above all, warriors. Their knowledge of agriculture was limited; they were gregarious and lived by the chase and upon their flocks. Bold, adventurous and self reliant, they stubbornly preserved their tribal relations to the end, and it

Carriage in Russia.

was through the divisions and jealousies these conditions engendered that their enemies were enabled finally to overcome them.

Such were the Greeks. They gave much and borrowed little. Creative and imaginative, their intelligence subjugated the world and still influences its destinies. It was amid such conditions that the hardy Ionian sailors, the First Common Carriers, were evolved.

CHAPTER II.

RAILWAY KNOWLEDGE AND METHODS.

Everything in life progresses or recedes. There is no intermediary stage. Business is progressive. It sloughs off today what was yesterday an integral part. Except for such changes, progress would cease. It is the secret of the great advances railways have made. This progress will continue as long as a large number of men continue to interest themselves in their affairs. Not longer. And herein lies the danger of adopting a uniform implement of any kind, such as a car wheel, brake, coupler or switch signal; men then cease to study the question; they settle down to a belief that perfection has been reached. Discoveries that would under other circumstances be made, remain undeveloped in the inventor's brain. He is handicapped by having to compete against a thing that is accepted as the best of its kind. The moment he attacks it he is accused of being an idealist, perhaps a crank by many, including those interested in bettering the service; he is looked upon as a disturber. To secure the introduction of his idea requires years of labor, outlay, disappointment, humiliation. This is what it means to attempt to overthrow or change anything that is standard,

Rural Carrier.

anything that has been agreed upon as the best. And herein lies one of the principal objections to government control. It retards progress. Everything a government adopts becomes standard; inviolable; the best of its kind. The instincts, prejudices and comforts of government employes and those they deal with are concerned in perpetuating it; a dull, plodding, mechanical group take the place of alert owners and ambitious employes. Such is government ownership or government supervision.

The construction of railroads and their progress and development are due to constant experiments and changes; to dissatisfaction with what exists; aspirations for something better; to a love of gain. Except for this spirit, which is not found associated with the mechanical offices of government, we should be traveling by the stage coaches of George the Third's time, or, if we had railroads, they would be like those of forty years ago—high priced, cumbersome, insufficient, slow, inadequate. The railroads of today, by which the developments of a century are consummated in a decade, are due to the genius of innumerable men; but above all to the genius of proprietorship, the instinct of private ownership, private gain. No one can take the place of the owner. "It is always better that trade and industry should as far as possible be left to private enterprise. Government management is almost invariably wasteful and inefficient."*

* Professor Henry Fawcett.

Nowhere in the world are there men of higher intelligence than those who operate railroads. They comprise so great a number, however, and are so widely separated, that it is necessary to govern them by definite rules. Now, there are two ways of laying down a rule: One says, "You must." This will do, if the master is on hand to see that it is observed; otherwise, it is like firing into the sea. A few conscientious men will ob-

Carriage in Constantinople.

serve it from principle; the mass, however, will not regard it except so far as punishment attends neglect. The reason is, not that they are wilfully disobedient, but that they are busied with other matters and, not understanding its importance, neglect it. No one, if left to himself, will carry out an order of which he does not understand the force. The other way to give an order is to accompany it with an explanation of its pur-

pose and necessity. By this means the person addressed becomes a party to the transaction. The order appeals both to his judgment and fidelity. There are, therefore, two reasons for expecting its observance, where there is only one in the first case.

In many instances explanation is impossible in business transactions; no one understands this better than employes. But, generally speaking, co-operative effort can not be carried on efficiently where there is not concurrent knowledge. It is not only necessary to tell men that they must do a particular thing, but to tell them why. This is the purpose of these books. They do not aim so much to lay down particular rules as to explain the necessity for and the value of such rules.

It is apparent from a perusal of the accompanying book and that devoted to disbursements that the subject of railway supplies is worthy of more general attention than it has received up to this time. Great progress has been made, but the subject is still imperfectly understood. Practices are still accepted more or less generally as orthodox that will not stand the scrutiny of intelligent investigation. Many of the defective methods that attend the handling of railway supplies are, however, inherent; the result of want of understanding and proper provision in the laying out of railway shops and grounds in the first place.

The supplies of a railway have been likened to those of an army. They are infinitely greater,

but are capable of being surrounded with better checks and safeguards. A quartermaster may square his books by an entry "Lost in battle." But the manager of a railroad can be made to account for the supplies he buys to the utmost farthing.

The relation that the articles used by railways bear to each other varies on different lines, ac-

Carriage in Cairo.

cording to the nature of property and business. Cost is dependent upon the quantity purchased, proximity to market, the skill of the purchaser, financial ability, etc. The number of articles that a company uses is so great that a schedule of them would fill a volume. I started out to make a list, but found it impracticable. The statistics of many railways give the kinds of sup-

plies used for repairs and maintenance and the cost thereof. I do not remember, however, to have seen a table giving the aggregate cost of each kind of material for a road as a whole. It would not perhaps be advisable to go to the expense of such details. They are more interesting than valuable.

The intelligence and fidelity exercised in the purchase, care and use of railway supplies influence directly the cost of construction and operating, and affect, very materially, the profits of owners. To the bulk of railway men the subject is an unknown quantity. It can not receive too much study.

The amount standing upon the books of a company charged to supplies should comprise the material, both new and old, in store. In pointing out safeguards for the faithful and economical handling of material, I am led to discuss the best means of insuring its careful and prudent use after it passes into the hands of employes; loss or waste in such cases directly affects the supply. This enlarges the subject and enhances its importance.

A word here in reference to my books on railways. They refer to my business, and have had for their purpose the advancement of the interests of my employer. If he has derived no benefit therefrom, I have fallen into the mistake, made by so many men occupying similar positions, of overestimating my services in his

behalf. In reference to the scope of my writings, they are intended, it is proper to say, mainly for the young and advancing class among railroad men; for those who lack opportunities of learning; for those who desire to know the subtleties of railroad affairs, yet are prevented by their environment. The interests of railway companies require the widest diffusion of knowl-

Carriage in Lisbon.

edge among their officers and employes, but, unfortunately, there are no present opportunities by which it may be acquired, except as they pick it up piecemeal, here and there. My books are intended, so far as their limited scope applies, to supply this deficiency. The Managers of railways have, generally, no need of information in this direction; their great talents, experience and

opportunities make their knowledge cosmopolitan; make them teachers; the natural exponents of railway policy and practice. The knowledge they possess, however, has a tendency to make its exposition by others appear unnecessary. This is the error that men fall into whose appetite has lost its elasticity through over use; the mistake of successful men; of men whose ambition is gratified. They forget that the stale platitudes of today were to them the delights of yesterday; that what is common to them, is the source of the liveliest curiosity to their less favored brethren.

I have been more or less criticised for writing on railway subjects. But I have never written a word except to advance the interests of railways, of those who work for them, and those whom they serve. Criticism, whether friendly or not, benefits. While a man must have friends, it is not an unmixed evil to have about him active enemies. If they should happen to be a little malevolent, so much the better. Men thus surrounded are kept bright and active; their egotism is not allowed to eat up their vitality. Men are spurred on to achieve results quite as much by enmities as by more amiable considerations. In early life I prayed to be delivered from my enemies. Now I feel that I have never had enough of them, or that if plentiful, they lacked activity and force. I find, in looking back over my life, that I owe much that I have achieved to the efforts of enemies to rob me of

some right or to keep me from doing something I had not thought of doing. My experience is not peculiar. Men are too amiable. They allow themselves to be crowded out by the swine about them. They frequently require incentive, oppression, bitter personal animosity to spur them on. Every man who desires to become great or

Carriage in Japan.

to remain so should pray to have around him active, energetic and influential enemies. If, therefore, the officials and employes of railroads who fill their departments and bureaus should find themselves surrounded, as they will oftentimes, with jealous and unrelenting foes, they must not look upon the situation as one devoid of good.

CHAPTER III.

PROPERTY VERSUS POVERTY.

Envy is the curse of our day. If the Commandments were to be rewritten, the sin of covetousness would be the first named instead of the last. Nothing in the history of the Jews reflects more credit upon them than the fact that this sin was esteemed the least of their vices.

Its enormous importance at the present time grows out of a false conception of the relations that men were intended to occupy toward each other. It is partly due to a belief that through "cramming" and other processes the dull and worthless may be made the equals of those upon whom God has stamped the highest attributes. Out of the truism that all men are equal before the law has grown a belief that they are equal in everything. Hence the jealousy and rage of the improvident, the incapable and worthless toward those who through their wisdom or self denial are able, while supporting themselves, to add to the wealth of the world.

The desire to be rich is laudable; but to desire a thing because our neighbor has it, is base. The secret of man's happiness is contentment, coupled with an honest desire to add to his position and

comfort. Out of these the greatness of the world has grown. Envy and jealousy have never advanced mankind in the direction of either greatness or goodness. Directly the reverse.

It is the curse of radical teachings that they make men envious. It is fashionable among

Carriage in Lapland.

many to ascribe the rapid advance of the world to such teachings. On the contrary, it is due to the prosy, conservative, plodding capitalist, who has constructed our telegraphs and railways and has had the genius to operate them successfully. Radicalism is a species of fever—the hectic flush that precedes death.

The wealth of a country is the evidence of the intelligence and thrift of a people; of their disposition to work, and the respect they pay to the rights of others. It evinces, especially, their ability to sacrifice present gratification to future good. Every dollar saved represents a luxury denied. This is true, no matter what the wealth of its owner. The desires of a millionaire and the pressure brought to bear upon him to dispossess him of that which he has, exceed the pressure put upon a poor man, in the proportion that his means exceed those of the latter.

A pleasure does not consist in the thing itself, so much as in the effort it cost us; in the deprivation that it represents; in its rarity, in fact. The banquet that costs a million dollars is not enjoyed more heartily by host or guest, or partaken of with feelings of greater self esteem, than that experienced by the colored man in the swamps of the Carolinas who invites his neighbors to partake with him of sweet potatoes and opossum. Nor is the discontent among those whom the rich man omits to invite to his board greater than among those whom the Carolinian fails to ask to his succulent feast. If, however, we make the latter believe, either through political teachings or otherwise, that he also ought to be able to give a million dollar banquet, without the expenditure of corresponding intelligence, labor and self sacrifice, then we shall destroy his happiness and his value as a citizen, without advancing the interests of mankind. This is exactly

what many of the political maxims of the present day are doing.

It is a compensating advantage afforded by a general and wise law of nature, that the poor man shall enjoy the luxuries his scant means afford with the same zest that the rich man derives from the expenditure of his wealth. When, therefore, the former is blessed with work and a contented disposition (and a contented disposition

Carriage in Constantinople.

is the natural inheritance of every man) it follows that he must be as happy as his neighbor. If, in addition to this, his habits are frugal, he, too, will acquire riches. He will commence by acquiring a competence. This will be his first aim. It is but a step thence to wealth.

Enjoyment is relative. It becomes impossible, however, the moment the spirit of jealousy and envy is interjected into it. Jealousy and envy evince a mean spirit, a narrow comprehension;

an evidence of moral obliquity; of a mind unable to enjoy that which it has or derive happiness from anything it may attain. It is the curse of our social life; it disturbs the slumbers of the poor man without bettering him, and is a thorn in the side of the rich.

The desires of the envious are not spontaneous. They grow out of the acts of others. They esteem not the comforts they have, but glance with lowering eye at the apparently greater comforts of their neighbors. Happiness under such circumstances is impossible. The mind is not soothed by success, by that which God has granted.

Envy is the outgrowth of forgetfulness; of selfishness; indifference to the fact that the thing coveted is the product of a sacrifice equal to its extent. That it represents, moreover, a principle that can not be disregarded without destroying civilization; without making might the arbiter, and destitution and wretchedness common. There are, of course, instances where wealth has been acquired quickly, through fortuitous circumstances, without special deprivation. Such cases, however, are exceptional and do not at all affect the general principle.

Whoever owns a dollar in money which is employed in reproduction, whoever has a dollar over and above his debts invested in business, is to that extent a capitalist. Capital is represented not alone by the circulating medium of the world but by the buildings, plant, machinery, supplies, stock in trade and appliances of manufacturers,

merchants, carriers and others. Whoever has a dollar's worth of property is a contributor, to that degree, to the world's wealth. Property represents prolonged thought, economy, self denial. It is born in labor and deprivation; it should be enjoyed in peace and contentment. The material interests of a country afford evidence of its strength of purpose, the grasp of its people. The acquisition and maintenance of property occupy

Carriage in India.

alike the thoughts and purposes of christian and pagan; of those already rich; of those who hope to become so; of those who possess a competence; of those who are struggling to acquire one. Man's struggle to better himself broadens his intelligence and multiplies his ability to help others. The inestimable boon that wealth conveys to the community is the opportunity it affords its possessor to give employment to others. No one who possesses within himself true ele-

ments of manhood seeks or desires other aid from his fellows than opportunity to work. This boon granted, he becomes the arbiter of his own fortunes. His progress may be slow, but this will not render it less attractive. The determination of a man to succeed increases immeasurably his value as a worker. His savings, meager at first, constitute the nucleus of a fortune. Once the start has been made, the future is assured. The value of saving is but poorly represented by the amount of money laid by. It is more fitly illustrated in the strengthening of the character of the person; in giving him a purpose in life, a fixed goal to be reached; in making him self contained; in filling his mind with ennobling thoughts; with lofty aspirations. Thus engaged, he has little time, and less inclination, to meddle in the affairs of others; to criticise their failures; to growl over their successes. The man who has acquired the habit of saving sees before him an old age secure from want; a life closing amidst contentment and happiness. He has no incentive to steal. He is not envious of those who have more than he, because he hopes to become their equal. The habit of saving represents industry, contentment, integrity, loyalty, exalted purpose, an honorable life, a green old age.

The avenues through which wealth may be acquired multiply with the thought given to them. Herein lies the secret of rich men. Their capacities are no greater at the start than others, but their purposes are higher, or if not

Carriage at Jelalabad.

higher, more steadfastly pursued. Their determination is greater and the necessity of sacrificing the present to the future more rigidly adhered to. Riches are the fruit of intelligent purpose; of indomitable perseverance, of prolonged self sacrifice. Poverty is too often the fruit of present gratification or of wasted opportunities.

Encouragement to save and the preservation of that which has been saved is one of the chief duties of the government; one of its greatest and most beneficent functions. Upon the care and wisdom thus exercised depend not only the present happiness and prosperity of a people, but their future. Such protection encourages those who have to increase their sphere of usefulness. It is also an incentive to those who have nothing to acquire first a competence, afterward a fortune. A government can have no loftier purpose than this; every other material good follows in its train or is collateral to it. It represents food, clothing, independence, enlightenment, manliness, contentment, respect for the rights of others.

The tendency of modern teachings is to make material things secondary to mere forms or words; to say that theory is superior to practice; that the world's history does not represent the wisdom of mankind, but its perverted purposes.

No country whose citizens do not aspire to fortune, and which does not possess avenues whereby this aspiration may be successfully pur-

sued, can hope to become great. The first step in the progress toward wealth is by hoarding; by saving something, however small. The insignificance of the sum frequently makes it appear absurd, the outgrowth of a base and mechanical spirit. This view of the subject is mistaken. The act of saving evinces the highest and best qualities of mankind. It is an evidence of self abnegation; of ability to help others. When once the determination has been made to save, the processes of thought it invokes make men

Carriage in Borneo.

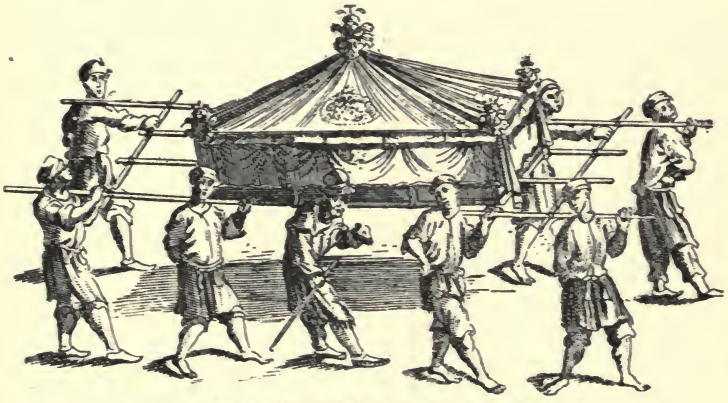
contented. They no longer look to vague and fortuitous circumstances for that which they desire. Their purposes become definite and settled. They do not look upon the possessions of their brother with the eye of a robber, but with kindly interest, availing themselves meanwhile to the utmost of his experience.

Whatever a man thinks, he becomes. The thoughts of an industrious and saving man look forward to a time when he will no longer be compelled to work. His dream of idleness is Utopian, because work is necessary, God's greatest

blessing, and its discontinuance foreshadows decay and death. But the prospect of a competence, the hope of a fortune, the dream of independence, stimulate him to labor and to save. When a mind is once imbued with the acquisition of property, it grows with what it feeds upon, multiplying the usefulness of the man according to his talent and opportunities. The process of acquisition once set in motion, never ceases. On the other hand, the desire to possess without the disposition to labor and to save, is the instinct of a robber, of a common thief. That a person so constituted will, sooner or later, attempt to ply his vocation, follows as inevitably as honor and wealth follow in the case of his more unselfish brother.

The mistake that men make in believing that wealth will bring contentment and happiness without prolonged self sacrifice, lies in ignorance of the fact that to be fully enjoyed it must be honorably earned. As well might a soldier hope to enjoy as victor the battle won by his comrade, as the possessor of wealth hope fully to enjoy that which has been earned by another. The history of every self made man illustrates this, and while his predominating thought of self may detract somewhat from his merit as a social companion, it truly evinces the absorbing delight that the accomplishment of an object long pursued affords. He loves to talk of his achievements; to recount his adventures; his successful schemes; the labor they involved; the empires

of industry they gave birth to. The gratification he feels in exhibiting his wealth, his horses, pictures, houses, even his raiment, is the gratification of a child; the gratification that follows an effort long sustained and ultimately successful. We participate in his happiness, are refreshed by its ardor, and while we may not hope to be equally successful, can not fail to observe that it is the outgrowth of previous deprivations.

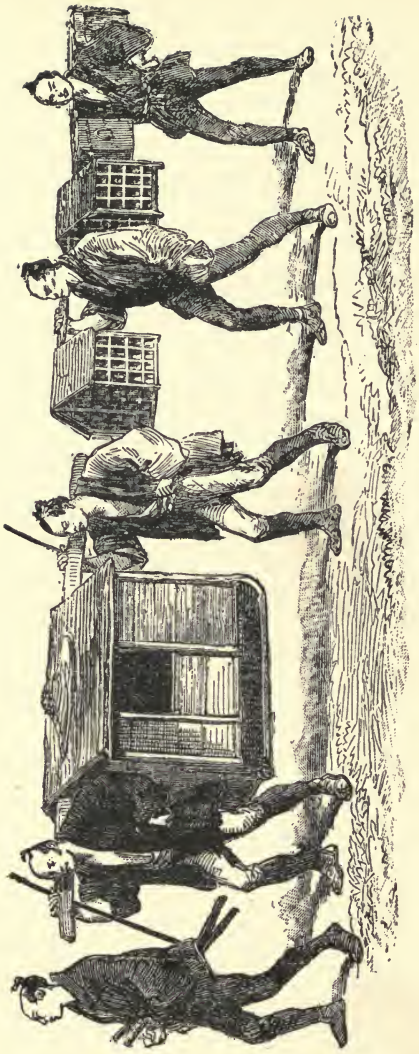


Carriage in China, Sixteenth Century.

Railway property, including money invested in Supplies, represents the accumulated savings of particular persons as much as the coal that is laid away by the widow for her winter's use represents her savings. Except for the saving disposition of mankind, there would never have been any capital with which to build railroads in the first place, or extend them after their success had been demonstrated. Every mile con-

structed, every new car built, represents money that has been hoarded. It is a material, physical evidence that many persons, instead of spending everything to gratify present wants, have laid aside a portion. To the extent they did this, the community is better off, enjoys better facilities, greater comfort, greater opportunities for making money. The employes of railroads are especially bettered by it; through it their sphere of usefulness in increased and their number multiplied.

In conclusion, it ought not to be necessary to say that no difference exists between the rights of those who own railway property and the rights of others. But the warfare that has been made upon railway corporations renders it proper. They are, equally with other property owners, entitled to protection, to earn a return on their investment. To deprive them of this right is to encourage a spirit of destruction to every kind of property.



Carriage in Japan.

CHAPTER IV.

RAILWAY SUPPLIES; NECESSITY AND VALUE OF HANDLING THEM SCIENTIFICALLY.

The supplies of a railroad are generally understood to mean new and old material on hand in store, not in use. Incidentally, however, they include property of a portable nature, such as tools in the hands of workmen, the due protection of which is important as supplies in store must be drawn upon to replace them. I shall, therefore, not only consider the question of supplies, but point out necessary safeguards in connection with their use.

The supplies of a railway constitute personal property. They are in the nature of a permanent investment. They have a current value in the market, yet are not available as an asset (except in the sense that the right of way of a railroad is an asset), for the reason that a property can not be operated without them any more than it can be operated without a track. They are, therefore, to be viewed from the same standpoint as the latter. They can not be disposed of and can only be slightly diminished in amount.

The custom in regard to the disposition to be made of supplies in the accounts is not uniform. It is not the practice, for instance, in America, to

Carriage in Japan.

capitalize these investments. The reason of this omission doubtless grew out of the fact that the amount in the early history of railroads was small and the credit of the companies so pinched as not to make it easy to capitalize expenditures of this nature.

The amount of material necessary for a company to keep on hand to meet current wants depends largely on the proximity of markets and the character and extent of the property and the amount of its business.

The value of railway supplies on hand, with the tools and light implements in the hands of employes, represents an average of about two and one-half per cent. of the total amount invested in railway property.

Each year adds to the number of articles that a railway uses. Improvements, new conveniences and luxuries swell the list. Upon some roads libraries, foot baths, barber shops, pianos and organs form part of the paraphernalia of the train and station service. The list will go on increasing until it embraces every article found in the most luxurious home.

Not only are the articles used by railroads multiplying from day to day, but they are also improving in quality. Manufacturers learn how to manufacture better. A car wheel that would average twenty thousand miles was formerly thought to be of high grade. Now wheels average from one hundred and fifty thousand miles to four hundred thousand miles.

Carriage in Abyssinia.

Supplies represent cash. It takes cash to replace them. They should, therefore, be guarded with the same care as cash. This is not usual. The reason is that the use rather than the value of the thing is considered. If we lose a package of money, the fact is bemoaned by a whole continent; the Associated Press recognizes its importance; the telegraph resounds with its details; local reporters exert themselves to ascertain particulars. If the employe of a corporation loses it, he is blamed, perhaps disgraced. If money is stolen, myriads of detectives prick up their ears in anticipation of the reward. When the agent of a railroad embezzles a few dollars, the staff trembles with suppressed indignation and no stone is left unturned to secure a return of the money and the punishment of the delinquent. This is the rule with cash; it is not the rule with supplies. The loss or improvident use of material is not known in the majority of cases, even by those immediately in charge. Why? Because of defective methods of handling material.

The amount of material at any designated point on a road is an unknown quantity. Absolute precision, as in the case of cash, is impossible. If there is a surplus or deficiency when the inventory is taken, it is adjusted in the accounts without remark, unless excessive or peculiar. Arbitrary regulations that govern in the case of cash can not apply to material. Those in charge of material are quite as honest as those who handle cash, but they do not have the same check

upon it; can not guard it with equal care. This breeds improvidence, carelessness of thought and action, and while any known offense is punished, discovery is not sure, as it is in the case of loss of money. This is demoralizing; it makes men forget that material has the same value to a company as cash, and that its destruction or improper use is equally disastrous.

In order to ensure necessary and proper safeguards in the handling of material, we must

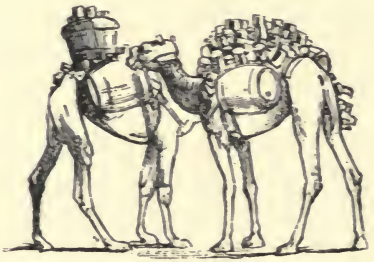
Carriage in Tunis.

consider it from the standpoint of value solely. To misappropriate or waste it must be esteemed the same as the misappropriation or loss of money. Its deterioration through lack of proper care must be looked upon the same as any other offense against good business usage. Its loss must be thought the same as the loss of money. It is no exaggeration to say that a cashier who would use a drawer that contained cracks through which more or less money was lost, or who stored his cash on window sills and in public entries,

would be considered improvident in his methods of business. The losses that occur in connection with material that are avoidable, within just and reasonable limits, are as inexcusable as the loss of money under the circumstances named.

The disparity that exists between the care of property and the care of money is ludicrous, not only upon railroads but elsewhere. We watch our money with unceasing vigilance; when we receive it we count and recount it, examining it meanwhile with eye and tooth. While it is in our possession we store it in costly vaults and in safes at once the pride of artisans and the despair of burglars. When we pay it out we count and recount it as before, and at the close of each day particularize our payments and sum up that which we have on hand with the utmost precision lest a penny should be lost. This care is not exaggerated. It is the result of experience, of necessary precaution. What are the practices of railroads in regard to material? Is the same provision made for it that the merchant and manufacturer practice? Hardly! The purchaser inspects it when it is received, but in consequence of lack of experience and proper facilities many counterfeits are palmed off upon him. When received, he does not place it in costly vaults or safes, nor even behind oaken doors or carefully barred windows. The smaller articles he places in what he calls a storeroom. This storeroom is, however, in many cases, nothing more nor less than a few shelves loosely con-

structed in a roundhouse, or a corner partitioned off, perhaps without locks or bolts. If the supply of material is large, a special room is assigned. But this room, in the majority of cases, is much too small, and its internal arrangements ill adapted to the purpose it serves. Whatever its character, it is used only to store small supplies. The great bulk of the material lies scattered about the buildings and yards. Some of it is waiting to be used on the morrow; some of it



Carriage in Delhi.

has been overlooked. It is scattered, because there is no convenient place for it. It is suffering more or less deterioration; many articles are lost or stolen, while such material as oils impregnate the earth with their drippings and perfume the air with their odors. The picture is not exaggerated. There are, of course, exceptions. I have in mind storehouses constructed recently in the light of experience and known wants that are in every way adequate. These are the exceptions, however.

The blame does not attach to the railroad managers of today. It antedates our time. Innumerable causes, however, tend to perpetuate it.

The scant thought given to the subject originally by those who planned our shops and depots of supply strikes the observer with amazement. If, when we paid money into a bank, it were necessary for the teller to crawl over a contiguous counter, through an open window, past a long line of men engaged in various occupations, in order to reach his money drawer, located in a coal cellar, we should say that the bank was poorly planned, if economy in its working and safety in the care of its funds were desirable. Yet the practices in regard to the handling and storage of material in many instances are quite as absurd. And what is more remarkable, is that they excite neither surprise nor suggestion.

It is probable that the defective system of railroads for handling material grew, primarily, out of a division of responsibility. It sprung up, like "Topsy," without method or forethought. Where shops were planned by an engineer, he was not called upon to make provision for supplies, or, if he was, the storehouse was inconveniently located. The rule was to construct such buildings out of remnants; not with reference to convenience of unloading, storing and disbursing, but with a view rather to the utilization of an unoccupied spot.

While elaborate provision has been made by railroads for their equipment and machinery, the

storeroom for supplies has been forgotten or ignored. Nothing could exceed the convenient character of our machine shops and roundhouses or the minute care that has been exercised to see that all the parts conform to the use to be made of them. Every device by which economy of labor and the protection of the plant can be secured is carefully considered. The same standard of excellence should be observed in regard to

Carriage in Burmah.

the supply stores. The standard should be the standard of private practice.

It does not require any extended or technical knowledge of railway affairs to teach us that the same care should be observed to protect railway supplies that a prudent and thrifty merchant uses to protect similar merchandise. To the extent this is neglected, we are remiss. The occasion of this remissness may excuse it, but it does not alter the conditions. To say that it is the result of lack of forethought and not of

design, of inexperience and not of deliberate intention, does not make the loss any less to railroad companies. We must not expect, however, the high standard of the merchant. In his own business he is personally on the ground to plan, arrange and inspect; moreover, his intelligence is heightened by the instinct of gain, of ownership; an hereditary instinct, the instinct that one merchant hands down to another. Those who operate railroads have not the habits of merchants, nor their personal incentive. This does not imply that they knowingly or wilfully omit any precaution or violate any law of ethics. The standard of morality among them is, probably, quite as high as it is among merchants. It is less effective in its methods, that is all. It approaches the perfection of the merchant only so far as it is supervised by men possessing equal intelligence and interest with the merchant, namely, the owner of the property.

Great progress has been made in handling material. Particular companies have given the matter thought and expression; they are exceptions, however. Proper provision is, in many cases, impossible at the present time. The room is lacking and the arrangement of shop buildings prevents. Originally the cost of storehouses led many companies to get along without them. That such economy was not justified, no one familiar with the subject need be told. In the inception of railroads in America the poverty that enveloped them knew neither time nor

Carriage in the Desert.

utility; it sacrificed, in its improvidence, both the present and the future. That the saving on the outlay would have abundantly justified the construction of adequate and properly located storehouses, we now know. But criticism can not remedy the evil. It may, however, prevent similar neglect hereafter. Intelligent study of the subject may do much to ameliorate the situation.

Not the least of the evils that a company suffers from improper methods of storing material is the demoralization it engenders. It does not seem wrong to appropriate what is esteemed so lightly; to improvidently use what apparently has so little value. Thus losses multiply. Moreover, imperfect knowledge of supplies on hand engenders excessive orders. It is impossible to properly inspect or classify material or watch its disbursement with the care that should be exercised when the facilities are inadequate.

No company can be so poor as to justify neglect to make proper provision for handling its supplies; to protect them from the elements; to throw around them such safeguards as are necessary to prevent their loss or improvident use. For articles that have a current value, such as copper, brass and tools, secure storehouses should be provided. For oils and kindred substances, capacious tanks should be built, in which they should be stored, and from which they may be drawn without waste or labor, as needed. For bulky articles that can not be carried away sur-

reptitiously, simple sheds are all that is needed. For old material, room is needed, first, for assorting, and afterward for protection. Provision for storing should, in fact, be such as a merchant provides under like conditions. The value is the same; the risk that attends neglect the same; the cost of replacement the same. This is not only true in regard to supplies about the shops and roundhouses, but it is also true in regard to the material scattered along the road, whether

Carriage in Afghanistan.

new or old. Every section of a line should not only have a place in which to store tools, but a secure place in which to store supplies and worn out material. It is necessary to prevent loss and depreciation; it is also necessary to enable the foreman to render an intelligent account of the supplies and implements on hand.

The economical use of material is of the greatest importance to a company. To secure it every department of the service should be carefully

watched; every device adopted; every expenditure guarded. Valuable material should not be used when inferior grades will answer; good timber should not be used when poor timber will do; in making requisitions for timber the right sizes should be ordered and in cutting waste should be avoided; lumber should be covered and so piled as to leave free circulation of air; timber taken from worn out bridges and other structures should, when practicable, be utilized for heating stationary engines, kindling engine fires, blocking, etc. High priced lubricants should not be used when cheap grades will answer; no more oil should be put into the boxes than is necessary; oil cups should be set so as to feed only the amount required to keep the parts lubricated; oil droppings from turning and other machines should not be thrown away, but drained and used again; waste for wiping should be used until its absorbing power is gone, after which it should be utilized to wipe the dirt from wheels and rough machinery; waste taken from truck boxes (when trucks are repaired) should not be thrown away, but used to pack other boxes; fires should not be started with lubricating or illuminating oils; track men should see that tools, bolts, spikes and other material are not covered up or lost; blacksmiths should exercise economy in the use of fuel, should see that it is not consumed unnecessarily or thrown away when cleaning their forges; coal should not be lost by overloading locomotive tenders; iron and steel should

Carriage in Persia.

not be exposed to the weather; finished iron should be protected by paint. These are only hints. The subject is interminable. Every device must, in fact, be exercised in the use and care of material that prudence and wise economy suggest.

The cost of the supplies of a company constitutes in the neighborhood of one-half of its operating expenses. This fact emphasizes the importance of rules and regulations governing them that shall be such as to secure the best results. The subject is too great to be more than summarized by me. The investigations I have made are such as to show that not enough attention is given the subject; that the waste in this branch of the service is much greater than is known.*

The handling of railway supplies naturally brings up the question of ability to buy cheaply. This involves incidentally markets, the ability of the purchasing agent, payment, quantity, place of delivery, and innumerable other questions.

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* Sometime ago one of the greatest railway managers of the United States asked the writer to prepare a code of rules and regulations governing the handling of material. The result is found in the chapter devoted to "Requisitions." In pursuing his inquiries the writer had occasion to investigate the methods of many railway companies, and while he nowhere observed intentional neglect or lack of interest, he everywhere found evidences of the slight thought that had been given the subject. The particular attention of the reader is invited to the chapter on "Requisitions." Under the rules therein laid down the manager referred to was able to reduce his stock of material on hand twenty-five per cent. while greatly adding to the efficiency of the service.

It also involves the due and proper inspection of material; its care and disbursement; and finally the regard that is paid to it after it has been removed from the storehouse. It also involves the question of distribution of authority; the status of the purchasing agent, storekeeper, operating officer, general management and so on. The greatest diversity exists in regard to the last named subject. On some roads the material is bought, inspected, cared for and disbursed by the

Carriage in Timsah.

same officer; upon other roads the purchasing agent buys the material and delivers it to the operating officer; upon other roads the supplies, after having been bought, are turned over to a disinterested department, presided over by the accounting officer. It inspects and cares for the material and disburses on orders from operating officers. It is thus a check both on the person who buys and the person who uses.

Upon some roads local superintendents have no power to order material except through one or

more superior officers. Upon other lines they are allowed to order directly from the storekeeper, the management striving in this way to make them sensible of the responsibility of their office; to fasten responsibility directly upon them. The practice is based upon a belief that the superintendent in charge knows better than anyone else the requirements of the service, and however much his requisitions may be scrutinized by superior officers, the latter are, after all, compelled to rely upon his judgment. If his requisitions are withheld or denied, the service suffers injury. No one but the official who personally watches the service on the ground really knows its needs. Where supplies are ordered, the greater the celerity in procuring them and the greater certainty the superintendent has that they will be furnished promptly and as ordered, the greater restraint (economy) he will exercise. Such is the line of reasoning the companies pursue, and upon it they are inclined to put great trust in the officers immediately in charge of the property. Some great and well managed corporations pursue the method I have described rigidly and systematically; they have found it to work with admirable smoothness and economy. It has been their experience that it builds up the morale of the force; that it also lessens the quantity and cheapens the kind of material they use. To those who criticise their methods they point to the fact that authority delegated to local officers may be withdrawn at a moments' notice

if abused. Moreover, while local officers are granted the right to order material directly, their requisitions are always subject to the inspection of higher officials after they are filled, and before if necessary. So that the check is not withdrawn, but is so applied as to increase the responsibility

Carriage in Nepaul.

of the local officer and build up in him a sense of dignity and responsibility. No service can be effective that does not keep this thought in view.

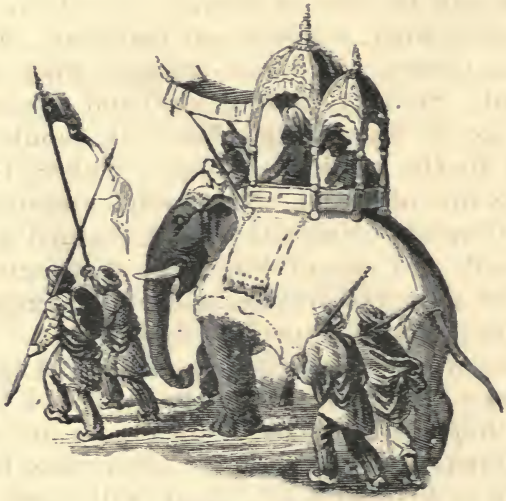
When a superintendent is required to secure the approval of those above him before he can get supplies, he is more intent upon getting his requisition filled than he is in restricting it to

the lowest possible limit; he shifts the responsibility onto the shoulders of his superiors. All officers do not, of course, do this, but it is in harmony with human nature where the discretion of men is not in accord with their responsibilities.

The questions that surround the subject of railway supplies are too numerous to be more than hinted at here. But the main purpose to be kept in view is to secure proper accountability in their purchase, care and use; to enforce needed safeguards; to prevent the growth of abuses; to stimulate the intelligence and zeal of every department interested; to be prompt in filling requisitions; to require full, minute and frequent returns; to keep advised, above all, of the quantity of material on hand and its location. The effective handling of material requires that when an article is ordered the department should know the quantity of such material on hand and where it is, so that the request may be filled by transfer from some other part of the road if possible. It is of the greatest importance that those who buy and care for material should be thoroughly versed in such matters. This I have endeavored to provide for in the provision I have made for handling requisitions.

An important provision in connection with the economical and responsible use of material is that it shall be charged to the account upon which used at the time of its use. In no other way is it possible for a company to keep itself advised of the quantity of material on hand; in

no other way can those who look to the accounts for information know whether they have been loaded down in advance, or have been lightened by neglect to charge for the material that has been used. Any other system is apt not only to deceive the owner of the property, but the management as well. Owners of roads look to re-



Carriage in Calcutta.

turns for a true exposition of their affairs—the actual surplus or deficit; the managers of railroads look to the daily, weekly or monthly returns for knowledge of details; they can not carry such matters in their heads, and if the system of accounting is not such as to refresh their minds at the proper time and place, they will forget. For an officer to attempt to remember

the details of what has passed is to greatly impair his knowledge of what is actually occurring round about him. If material is charged in advance of its use, the management will oftentimes forget that it is still on hand; if not charged when used, it will miscalculate the relation that expenses bear to receipts. Moreover, fictitious balances will be created whereby everybody will be misled—owner, investor and manager. Material, like money, should be charged when it is expended. So long as it is on hand it should appear as an asset; when used it should be charged to the proper account. Unless these practices are observed, comparative statements lose their value. Material will be charged when convenient, and one of the greatest safeguards connected with the service, one of the greatest checks on the management, will be lost.

In reference to details no two roads will agree. Differences in organization, in facilities, in location of shops, in methods of buying, in delivery and settlement, will exist. The differences, however, are not important. They will agree, or should agree, in regard to essential matters. There are certain general principles which ought always to be observed. These I propose to discuss in this volume and in the attendant volumes that refer to material.*

* In another book, devoted to "Fiscal Affairs, Disbursements," will be found several chapters referring to material. The rules and regulations laid down therein must be observed substantially upon every road where correct methods are followed. The volume on "Financing, Building and Maintaining" also treats more or less specifically of railway material.

Carriage in Palmyra.

CHAPTER V.

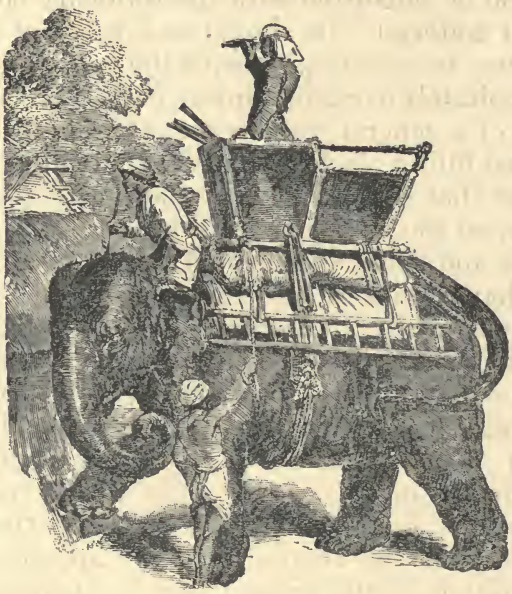
THE PURCHASE AND CARE OF SUPPLIES—NECESSITY AND VALUE OF PERFORMING THE WORK SCIENTIFICALLY.

To handle material properly, a company must have a corps of storekeepers, skilled in the knowledge of railway supplies and faithful in the care and disbursement thereof; men who in inspecting are able to determine their character, and who may be trusted to make a true report thereof; men who will guard the property while in their possession and see that it is disbursed only for good and sufficient reasons; men who will, so far as possible, look after its disposition after it has passed out of their hands; men of sufficient judgment and experience to anticipate the wants of the service and direct the delivery of material at the point most convenient for its use. They must not only be trustworthy, but must be miniature merchants, so to speak, with the provident instincts of merchants. They are important factors in the working of a property. They must also be familiar with the material accounts of railroads.*

They must be men of such character and judgment that they can be trusted to look after the

* For details of these accounts, see book entitled "Fiscal Affairs, Disbursements."

interests of their employer without continual spur or special commendation. They must be honest, intelligent, experienced, vigilant. They must, moreover, have such adaptability of manner and disposition as to be able to live in peaceable accord with officials of the company about them,



Carriage in India.

but over whom they have no control and from whom, in many cases, they will receive little or no aid. This involves tact and amiability. A company requires such a man at every supply store. To him subordinates and attendant details should be left; to him responsibilty for the

receipt, care and disbursement of material should be entrusted. Due efficiency requires that his clerical force and attendant laborers should be responsible directly to him and that authority over them by others should be exercised through him. It is not necessary that a storekeeper should be entrusted with discretionary power to order material. He should, as a rule, act in such matters in co-operation with the operating officer immediately in charge, unless, perhaps, it be in the case of a general storekeeper, who orders for all.

Men filling places of trust fall readily into a belief that a knowledge of the duties they perform, on the part of others, lessens their importance and loosens their hold. This is true of a mechanical office, or if the occupant is unfit. Not otherwise. It may be set down as true, that the more generally the methods of railroads are understood, the more efficiently they will be managed and the more profitable they will be to their owners. There is nothing about their system of operation that calls for secrecy, and the wider the diffusion of knowledge, the more thoroughly the community will appreciate the magnitude of the subject and the necessity for the work being carried on by owners according to approved methods of business. The importance of officials will not be lessened by publicity, and properties will be benefited.

In reference to the procurement of supplies, details can not be too minutely pictured. They embrace a knowledge of the peculiarities and arti-

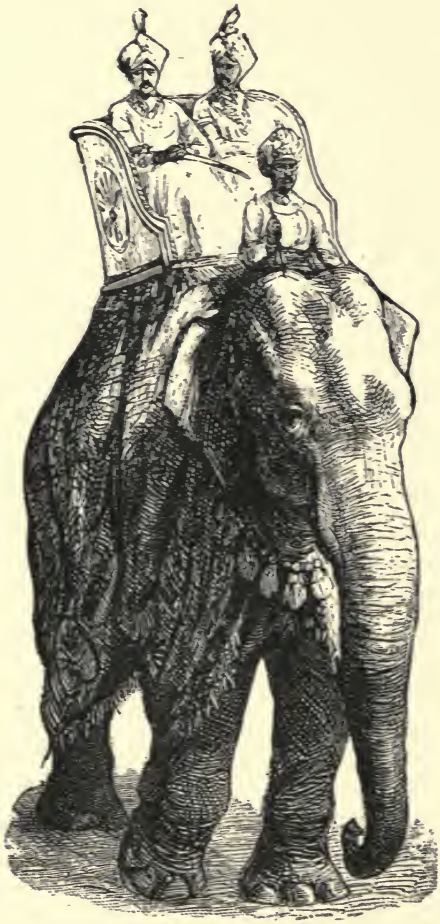
fices of tradesmen, the fluctuations of markets, and the conditions that attend the production, transmission and use of each article. The list of goods that a railway company buys practically embraces every known article used in the econ-

Carriage in Jeypoor.

omy of life. It is apparent, therefore, that any description must be largely general.

The practice of designating a particular person to buy the supplies that a railway company needs is not universal, though more prevalent than formerly. At one time it was the custom to permit the various heads of departments to buy.

The practice was based upon the presumption that their knowledge of technicalities made them especially fit to buy advantageously. The argument was, however, fallacious. It ought not to require demonstration to prove that a person hired for his skill as a blacksmith is not likely to possess the qualities necessary to enable him to to cope successfully with the veteran merchant in purchasing the goods that a blacksmith requires, or in disposing of the *débris* that accumulates about a blacksmith's shop. These duties are commercial and require a trader. It was found, moreover, that when purchases were thus made, the act was looked upon as merely an incident; something in the nature of a perquisite which the buyer was at liberty to avail himself of at pleasure. It resulted that collusion occurred where purchases were not supervised by an alert and trustworthy manager. There was, moreover, enormous waste of material through excessive purchases and duplications of orders, while prices became greatly inflated because of the ignorance and venality of buyers. These disadvantages were aggravated by the fact that much of the material bought and paid for was never delivered, and purely mythical, in fact. This was rendered possible by making the department that purchased the material and the department that received and inspected it, the same; a doubtful practice under any circumstances and one that should not be permitted unless the agent is a man of the highest integrity and unselfishness. These



Carriage in India.

and kindred practices were not the result of design but of evolution. No other way was known. It was not supposed that anyone who was lacking in technical knowledge of the uses to which a thing was to be put, could buy it. Time has shown the fallacy of this belief.

The element that makes a purchasing agent valuable to his employer is the mercantile instinct. If he has the characteristics of an artisan he should occupy the office of an artisan; the latter, however great his worth, is not qualified to cope with merchants, and his company will only be worsted in such an encounter.*

An essential requisite in a purchasing agent, and one that he ought to be fully alive to, is promptness. The operations of railroads are imperative, and while there is abundant opportunity to economize by cutting down excessive requisitions and cancelling others, this process must not be allowed to interfere with the prompt filling of necessary orders. When it does, the service suffers thereby. The work must be done systematically. A supervisory duty of this kind requires an active, energetic, conscientious man, who has extended knowledge and abundance of time.

No one appreciates so heartily as the operating officers of a railroad the peculiar embarrassments that attend neglect to fill requisitions

* For fuller particulars of the characteristics of a good purchasing agent and the duties of his office, see chapter on that official in volume "Organization and Forces."

promptly. Neglect necessitates the use of unfit and expensive substitutes, and, in many cases, stoppage of work or the retarding of important repairs and renewals. Delay in the receipt of material that is needed also involves hurried and imperfect inspection when received, and a disregard of economical and responsible methods of distribution afterward. It involves not only loss, but confusion and scandal. Promptness is an essential requisite.

Carriage in Thibet.

The more the subject is studied the more apparent it will become that, except under peculiar circumstances, the interests of a company will be enhanced by the employment of a particular man to buy its supplies. When they are purchased by many men the manager must, practically, assume the duties of purchasing agent through the minute and unceasing vigilance that he exercises over those who perform the duty. This but few managers have the skill, time or disposition to perform properly.

In order to buy advantageously, it is essential that orders shall be far enough in advance to afford the purchaser abundant opportunity to avail himself of the most desirable market. The field is wide and requires both time and patience in order to take advantage of its opportunities. Undue haste is quite certain to add to the cost, and in many cases detracts from the value of the article purchased.

In order to buy cheaply, it is also important that the purchaser should be free to buy where he can to the best advantage. His duties require him to scrutinize the sources of supply constantly and intelligently.

In order to buy cheaply, goods must be paid for promptly. The usury that a company suffers for a disregard of this rule is out of all proportion to the benefits derived. A large percentage of the profits of many merchants arises from the discounts they receive or the penalties they enforce. The fact is fully appreciated by purchasing agents. It is not, however, so generally understood by their associates, and it results that this profit is oftentimes lost in consequence. The loss, however, it entails upon railroads is not so great as it would be in the case of small buyers. The purchases of railroads are so large and their credit is so high that they are able to purchase much cheaper than those who have not these advantages. This is especially so when the railroad company observes its obligations in regard to time and method of payment. Under

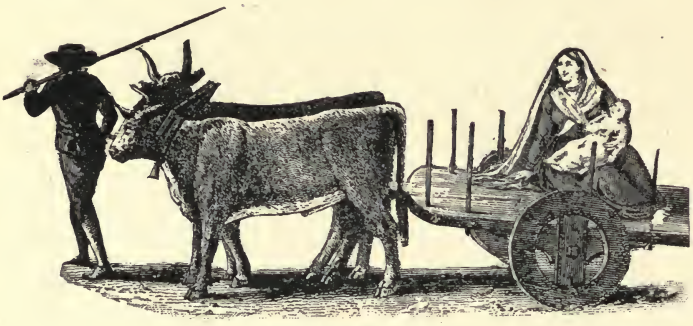
Carriage in Burmah.

the most favorable circumstances, however, there can be no doubt that the ability of a company to buy cheaply will be greatly enhanced by prompt cash payments.

In buying material the value of inviting bids whenever possible is generally recognized and acted upon. The exercise of this practice, when accompanied by careful and unceasing "shopping," has the effect of securing to a company every possible advantage that attends the purchase of large quantities of material in a widely extended market. The value of inviting bids is not dependent upon the quantity of goods bought. The difference in the price asked, even for a small thing, by different merchants and manufacturers, justifies it. Thus, in so small a matter as the purchase of stationery, the solicitation of bids will develop the most wonderful differences in prices; differences so remarkable that the aggregate amount that may be saved by judicious buying in the course of a year would not be believed by those who have not investigated the subject. The same is true of the purchase of lumber and other descriptions of material.

To buy cheaply and advisedly, it is essential that the pulse of the market should be constantly felt. This necessitates extended correspondence and constant personal inspection upon the part of the purchaser. The systemization of railway business that is constantly going on renders it more and more easy each year to anticipate the current

needs of a railway. One of the most effective avenues of buying cheaply is to publicly and generally invite bids from manufacturers and others for a considerable period ahead. This requires the preparation of careful estimates in advance and the granting of considerable time in which to deliver the goods. The evolution in railway practice heretofore has not rendered this practice generally possible. The purchase of rails, ties and kindred staple articles has, however, formed an



Carriage in Portugal.

exception to the general rule. These supplies are of such magnitude and cost, and require so much preparatory labor, that it has, as a rule, been necessary that their use should be carefully anticipated and contracts made long in advance.

Some of the most carefully managed railroads invite bids by public advertisement for a year's supply of such articles as their known wants enable them to anticipate, without reference to the magnitude of the order. This secures the widest

knowledge and consequently general and active competition among sellers. It is in every way creditable to a company practicing it, and when supplemented or attended by active and unceasing "shopping," secures to the purchaser every possible advantage. While every railway company will derive benefit from the widest solicitation of bids, it is probable those companies remote from an abundant market will be more greatly benefited by such a course than others. Their necessities compel them to keep a large supply on hand, while their restricted market places them at a disadvantage in buying, unless through general and judicious advertising they invite the attention of the world to their needs.*

In conclusion it may be said that the practices of railway companies in regard to the purchase, care and use of material can not be severely criticised. The work is generally carried on intelligently by alert and experienced men alive to the requirements of the service. However, the subject is still imperfectly understood by many higher officers of railways, and until it is understood the service will suffer greatly.

* "An essential feature, and one often overloooked by purchasing agents, is the necessity of merchants exercising promptness in filling orders after they have been placed. If storekeepers can depend on having their orders filled promptly, it will not be necessary for them to keep excessive stock on hand in anticipating delays."—*Writer on this subject.*

Nomadic Carriage and Dwelling.

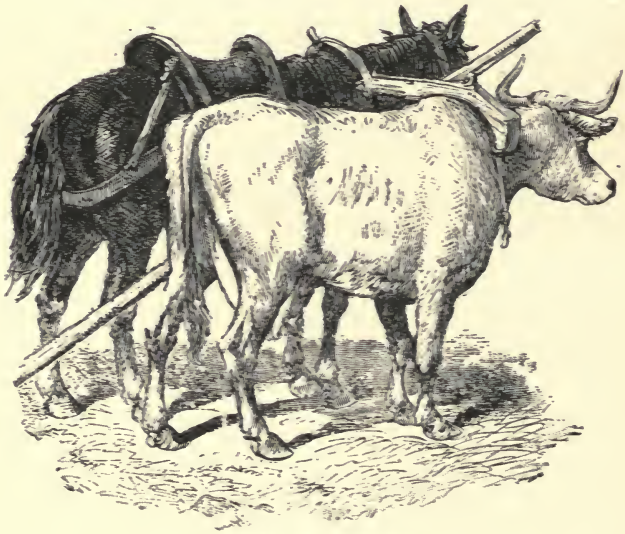
CHAPTER VI.

ORDERING SUPPLIES—NECESSITY AND VALUE OF PERFORMING THE WORK SCIENTIFICALLY.

The difference between ordering all the supplies required by a railroad company and those required for one of its shops or divisions is very great. In the former case the storekeeper's knowledge must be supplemented by wide experience, careful inquiry and voluminous records. In the latter, an examination of the shelves of the storeroom and the material piled in the yard will do very well to enable him to make his requisition. In the former case the records must show the material on hand at the commencement of the month, the amount received during the month, the amount on hand, the amount used and for what purpose used. A record of this kind is indispensable. But while showing how much material has been used, it will, in many cases, afford no idea of the amount needed, as consumption is likely to be affected by extraordinary demands for repairs, renewals, construction, etc. For this reason the storekeeper must supplement his book knowledge by constant intercourse with the operating officers who use material.

As nothing that concerns the operating department of a company originates with those who

handle its supplies, it results that they know nothing of impending wants, and it is only through those who control the work that they can keep themselves advised. Their ability to procure this information and the intelligence they display in anticipating current needs is an



Carriage in Piedmont.

evidence of their fitness. If the methods of a storekeeper are imperfect, it will be observable in his work; his orders will be lacking in perspicuity, and he will find it necessary to supplement stated requisitions with frequent orders to meet unforeseen emergencies; material will have to be bought hurriedly, and at a disadvantage, to meet

needed wants or to prevent the collapse of some department of the service.

The difference between a man who possesses executive talent and one who does not is the difference between a good storekeeper and a poor one. The former will anticipate the wants of the service with the same accuracy of judgment that a merchant anticipates the wants of his trade; if, however, he is lacking, his shelves will be loaded down with goods that he does not want, while there will be a scant supply of needed articles. A storekeeper of this kind will be a source of constant harassment to those about him and an expense to his employer.

Proper systemization of work requires that there should be stated periods for ordering material. Upon the majority of railroads a month's supply is all that is necessary to buy in advance. Too frequent ordering of material is objectionable on many accounts; first, because of the extra outlay it entails in handling the goods, and second, in attendant expense of accounting, payment, etc. Orders should cover such supply as can be conveniently, safely and economically stored, without involving depreciation or unnecessary locking up of a company's resources. No rule can be made. It will depend upon the situation of the railroad, the condition of the market, and storage facilities. If the road is remote, a larger supply will be needed than in other cases, because of inability to replenish the stock at will. If the market is a falling one, a

management will confine its purchases to the actual daily requirements of the service. If it is a rising market, or promises to be so, the supply laid in will be such as the resources of the company permit, the nature of the material justifies, and the probabilities of the market warrant. It is in such things as these that the management of a road evinces its sagacity. Success is measured by commercial instinct. If acute, it will be able to anticipate results; if dull or inattentive, the storm when it breaks

Carriage in Madeira.

will find it unprepared. It is the old story of fitness, with this added: that the men are not operating for themselves, but for others, and therefore lacking somewhat in self interest. They are, moreover, not selected in every case under the most favorable auspices. They are often chosen hurriedly, and not always with a knowledge of men. They are also sometimes selected from the standpoint of the agent, rather than from the standpoint of the employer. Such things effect and give color to the organization of governments and corporations.

The organization of different railroads in connection with the handling of material is not the same, as I have frequent occasion to notice. Upon some, requisitions are sent directly from local officials to the purchasing agent or manager; upon others, they are sent to a general storekeeper. This last seems to me to be, on the whole, the most advantageous. My reasons are that the supplies of a company should be concentrated as much as possible. They should be kept at some central storehouse and distributed therefrom as local operating officers require, keeping at subordinate storehouses only the amount needed for the moment. The supplies being thus concentrated, it follows naturally that the custodian thereof will possess a better knowledge of the material on hand than anyone else, and will, therefore, be better fitted than anyone else to tell how much it is necessary to buy, and how much may be procured by transfer between different storehouses.

When a company has a general or central storehouse, I think it would be a good plan to make all requisitions on or through the person in charge thereof. These requisitions may be sent forward by him afterward to the purchaser, with suggested changes. The effect will be to secure concert of action and tend to prevent purchases in excess of needs. It will remove questions as to supplies from the domain of speculation to a more solid foundation. The general storekeeper is the only one having practical knowledge of the

Carriage in India.

subject. His duties are of such a nature as to give him accurate and early information. He sees the material, and his knowledge is immediate and personal. The greater use, therefore, that a company can make of him, the greater the efficiency likely to characterize the handling of its supplies.

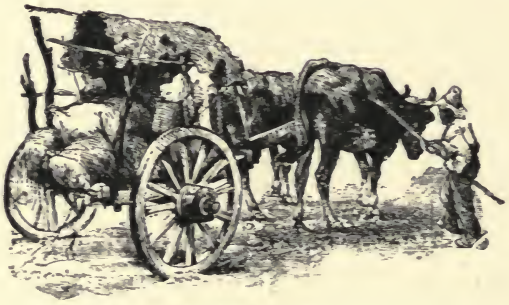
Where there is a general supply store it is desirable that supplies should be sent there for inspection and distribution whenever practicable.

The best method that can be devised for acquiring accurate knowledge of needed material will be defective. It will, therefore, be found necessary to make requisitions outside of the monthly requisition. Particular days should be set apart for these supplementary orders. They need not be many; say, the first and tenth. On these days all orders that can not await the usual requisition should be sent in. In addition to these, there will still be extraordinary necessities that can not wait any formal period. But if storekeepers are alert, these added requisitions will not be frequent. It does not alter the case that the storekeeper is dependent upon others for much of the information upon which he bases his requisitions. His ability to acquire this information is one of the evidences of his fitness. His methods must be such as the circumstances of the case require. He must use tact and opportunity in attaining the information he needs.

The great supplies of railroads, such as rails, ties and equipment, are of such importance and are governed by so many extraneous influences

that but little regard is paid to the orders of storekeepers in reference to such matters. The subject is carefully conned by the manager after patient inquiry and such purchases ordered as the need of the company and its financial ability render possible.

The amount of material that a company will find it necessary to keep in store will always depend upon the certainty of orders being filled as given and the length of time taken to fill such



Carriage in Chile.

orders. This fact should be kept in mind. If there is any doubt as to whether an order will be filled or not, or any doubt as to the time when it will be filled, storekeepers will keep a larger supply than they otherwise would. Delay or uncertainty swells the amount. They will provide against contingencies. This means greater outlay, greater waste, greater depreciation.

In ordering material, the supply should not be cut down below reasonable wants. The risk and

the special expense that attend a short supply are too great.

Not only is the intelligence of an officer evinced in the methodical preparation he makes for supplying himself with needed material, but also in the nature of such material; in his selecting that which, all things considered, is the cheapest and best; in his avoidance of that which has only outward show to recommend it for acceptance. Brilliant reputations are, perhaps, not made quickly in the exercise of economies of this nature, but their value to a property is very great, not only in regard to the saving effected, but in the morale they foster. The great and permanent properties of a country are commonplace in appearance and substantial in structure. Strength and durability are prime factors. There is no likelihood that the picturesque needs of railroads will ever be disregarded; there is no danger, consequently, that the use of the commonplace and homely makeshifts possible in their operation will ever permanently disfigure them.

In ordering material, the technical names that attach to articles should be used. All abbreviations should be avoided and descriptions supplemented, if possible, by such reference to cuts, drawings or numbers as may serve to explain more fully what is needed. When the article bought is different in any respect from the article ordered, the person making the requisition should be notified, so that he may inspect it understandingly, and if the change is injudicious,

Carriage in Bulgaria.

may have opportunity to correct it by subsequent representations.

The wide discretion exercised by managers in filling requisitions for material has a tendency to create confusion and irresponsibility if not carefully regulated. In the first place, those who order supplies should be made to feel that they are expected to confine themselves to absolute needs; that grave responsibility attaches to lack of good judgment on their part. It is only in this way that the growth of the competent and self reliant men that a great corporation needs can be secured. If we pursue the processes of children with them, we shall only attain the responsibilities of children.

When a requisition or order is changed by the official receiving it, the person making it (no matter what his station) should be notified, and the reason given. Co-operation under any other circumstances is impossible, and both the self respect of the man who makes the change and the man whose plans are altered will be increased thereby. The exercise of arbitrary power without explanation is always injudicious, where co-operative effort is necessary. Every person in his place must be made to feel that his responsibility is co-ordinate and that he is entitled to, and receives, relatively, the same regard as others. Men thus treated attach great importance to their actions and are careful and painstaking. At once there grows up in them not only the disposition, but the ability, to aid

those who look to them. Due consideration of matters of this nature is pertinent to the subject and necessary to its elucidation. Wise managers recognize them, but they are neither known nor recognized by those who view the operations of corporations from a personal standpoint.

There can be no doubt that the nearer those who simply serve are able to consider affairs from the standpoint of those who direct, the better agents they make and the more interested

Carriage in Mongolia.

they are. This is the observation of men accustomed to direct the movements of others; of the general, of the politician, of the business man. Its recognition will be beneficial to railroads.

In ordering supplies, due consideration must be given to the cost of handling, but it must not be given undue prominence. While expense may be saved by restricting the work within judicious limits, it should never degenerate into a mere matter of convenience.

In order to secure the greatest economy and efficiency in ordering material preparatory books should be kept, in which known wants should be entered as they arise from day to day. These books should be furnished to foremen and others, so that every means may be exhausted to ascertain in advance needs of the service.

As already intimated, economy suggests that all surplus material should be kept at a central depot. Such a course enables a company to keep the bulk of its supplies under its eye and permits a discretion not practicable when they are stored at widely separated points.

I will not refer here to details connected with the signing and countersigning of requisitions. Such matters are dependent upon the local practices of a company. They are not material. It does not matter whether a requisition is signed by the master mechanic, superintendent or storekeeper, so that it is authoritative and the person trustworthy.

In reference to the title of storekeeper, it is intended to designate the person immediately in charge of the material; whose duty it is to see that the supply is adequate; that it is duly cared for and properly disbursed. My purpose is not so much to describe what an organization should be as to lay down general principles. The title of storekeeper refers to a particular man in charge of material at shops and other depots of supply. Foremen in charge of track, bridges, fences, buildings and other branches of

the service, who keep on hand a supply of material, whether new or old, little or great, are storekeepers in a certain sense.*

Another and an entirely different class of requisitions from those already referred to is that made upon storekeepers by foremen and others for material for work in progress. These orders, experience proves, must be restricted to immediate and present wants.†

Carriage in India.

*The significance of titles and the key to them I have explained fully in other volumes. See chapter "Definition of Titles of Railway Officers and Employes—Key to their Significance" in volume "Organization and Forces."

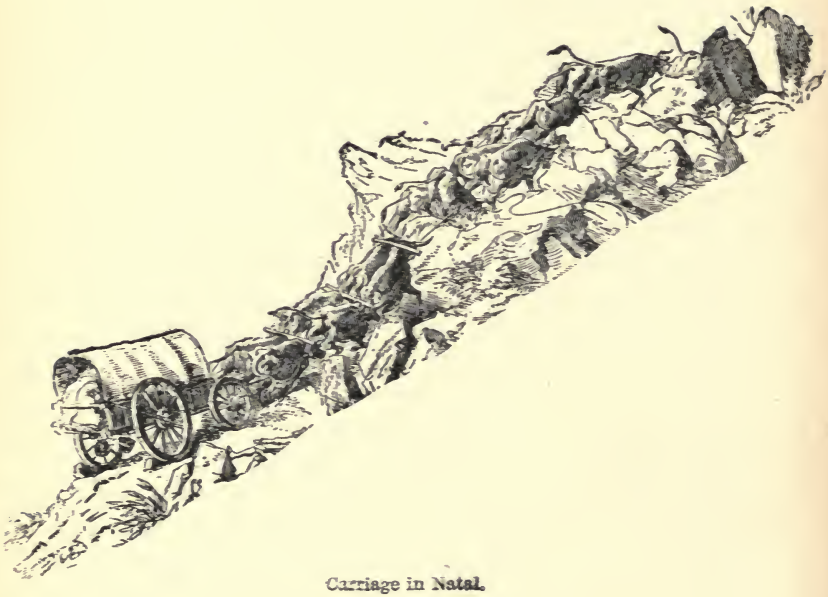
†It is the practice in some instances for storekeepers to deliver large quantities of material in advance of daily needs, charging the material when thus delivered directly to the thing on which it is finally to be expended. This saves the necessity of keeping accurate account of material as disbursed, and insures its being charged to the proper account. The practice, however simple and direct it may be, is not justifiable, no matter how much labor it may save the storekeeper or how convenient it may be in accounting. Material not actually needed by workmen for immediate use should remain in the jurisdiction of the storekeeper and should not be formally delivered to workmen, or charged to an account, except as it is actually disbursed for use from day to day.

Charges against operating accounts are based largely upon the orders of foremen and others. When, therefore, more material is delivered than is needed for the accomplishment of a thing, the excess should be returned to the storekeeper or accounted for.

Economy will be greatly advanced by enforcing stringent rules in regard to drawing supplies from storehouses for current needs. The clerical work of making an order is often looked upon as a disagreeable duty. The disposition, therefore, is to make as few orders as possible, and to make them cover a great deal. The result is to withdraw the material from the care of the storekeeper, where it is looked after with such watchfulness as facilities permit, to a place where it has no care at all, or only cursory supervision at best.

It also follows, where excessive orders are permitted (and they are inevitable, except where constant watchfulness is exercised), that material procured for one purpose is used for another, and, while this may not involve actual loss, it occasions confusion in the accounts and renders it impossible to determine cost. The tendency is bad. Responsibility is evaded, as a company can not tell whether work is being carried on economically or not. Foremen and others ordering material should be required to restrict their orders to known and immediate wants.

Orders for supplies for use upon trains and at offices and stations, and along the line, differ from those already noticed. They, however, require



Carriage in Natal.

the same careful and intelligent scrutiny. If the orders are large, those who make them feel the responsibility. But in the majority of cases the amount involved is so petty that due attention is not given it. The necessity of economy is overlooked. Such orders make, in the aggregate, an enormous amount, as the expenditures of a company evince. Due efficiency, therefore, requires that they should be carefully audited before being honored.

Judicious "pruning" of orders for small supplies will not only prevent undue expenditure, but will tend to prevent loss or misappropriation.

It is impossible for anyone not familiar with the subject to appreciate the saving that can be effected by restricting supplies to present wants and by carefully ascertaining, after an order has been filled, whether the supply is made to extend over a commensurate period. Upon some railroads this surveillance extends to minute articles. Its exercise excites, as may be supposed, the most heated controversies between the storekeeper and his natural antithesis—the person ordering; the former accusing the latter of extravagance, and the latter accusing the former of parsimony and with crippling the service through his pinching economy. Such friction is healthy, if confined within reasonable bounds. It prevents undue penuriousness on one hand and wastefulness on the other.

There is, it is probable, no more ungrateful task connected with the service of corporations

than the duty of passing upon requisitions and orders. However absurd or excessive, they are not esteemed so by those who make them, and any change or reduction excites their antagonism and chills their ardor; it is a reflection on their judgment, and they receive the rebuke according to their amiability or the thoroughness with which they have been disciplined, but always with bad grace. But the work is necessary if expenditures are to be restricted within reasonable

Carriage in Madras.

limits. The examiner must take cognizance of every article used. He must commence with orders for equipment, ties and rails, and follow on down the ever lessening items to the most minute article. Each requisition must receive the measure of attention it merits, without reference to the outlay involved, for the reason that business may be harassed quite as much by the want of a blank as by the absence of a bridge. The supervision must, therefore, be searching and discriminating.

The work must be conducted with judicial fairness; in a manner to invite confidence. The examiner must have a benignant temper; his patience must be equal to the most exacting requirements; his experience such as to fit him for the duty; his power of application commensurate with the tedious character and ungrateful nature of the work. No single person, it is manifest, can pass intelligently upon all the requisitions for supplies that a company needs. If the property is a large one, a man will have to be assigned for stationery and printing; another for lumber and kindred material; another for shop supplies; another for road supplies, and so on, according to the magnitude of the work. The fitness of a person making examinations is evinced quite as much by his ability to convince those whom he finds it necessary to overrule, of the justness of his action, as in the changes he makes, as it is only thus he can hope to prevent a repetition of the mistake. He must not only be able to wisely curtail expenditures, but to enlist the hearty interest of others in his work. This quality is rare.*

* For more minute reference see specific rules and regulations governing "Requisitions," embodied elsewhere herein. The chapter in question was prepared after careful study of the subject and investigation of the methods of many railroads. It has had the test of trial, and has been found to answer admirably the purposes intended to be accomplished by it, namely, to reduce the amount of material on hand to the lowest possible point; to make those who order material responsible therefor according to their knowledge and position; to surround the purchase of material with necessary safeguards without encumbering the opera-

If the duty of cutting down orders for supplies has a disagreeable side, it also has a bright one. There is, to a zealous man, probably no greater satisfaction than to think that through his unaided action he is saving his employer unnecessary expense. The performance of such a duty seems to measure the value of a man's service better than any other. He can, so to speak, count it in dollars and cents. The tendency, therefore, in him is to exaggerate;

Carriage in the Far West.

to consider the act rather than the office. His power tends to make him short sighted. Also

tions of a road with red tape. Particular reference is also made to the volume on "Fiscal Affairs, Disbursements," embodying not only rules and regulations relating to material, but also the theory and practices that govern the accounts connected therewith. It also embraces a minute description of the theory and practices connected with the keeping of the time of employes of corporations and how the same may be distributed most economically. Also other rules and regulations necessary to the keeping of the expenditure accounts of railroads efficiently, economically and clearly.

selfish. He does not like to share the credit of his efforts with others. He takes pride in being able to guard his employer's interests single handed. This feeling is exceedingly human. It is, however, none the less to be deplored; none the less narrow and short sighted. Whenever it is necessary for an examiner to overrule an associate or subordinate, the part of wisdom is to share the credit with the latter. By doing so he will not only strengthen his purpose, but secure an ally. And allied interests are essential to the good government of corporations. Individual reputations may not be so readily built up in that way, but great properties can only be thus maintained. Permanent results are to be secured only by making a force homogeneous; by making persons subservient to the common good without destroying their individual interest; by encouraging an unselfish disposition to serve the property; by striving to eliminate envy and jealousy from the service. These last two vices are the curse of corporate life, the natural inheritance of arbitrary men; the outgrowth of fear. They retard growth and render men unfit to exercise offices of trust.

CHAPTER VII.

REQUISITIONS—HOW TO REDUCE THE STORES OF A COMPANY, THROUGH SCIENTIFIC ORGANIZATION, TO THE LOWEST POSSIBLE LIMIT.

[EXPLANATORY NOTE.—Requisitions may be divided under two heads: First, requisitions to replenish the supplies of a company; second, orders on storehouses for material for current work. In a broad way they are both called requisitions. This chapter explains the principles and rules to be observed in handling each.

A good form of organization is this: First, a purchasing agent; second, a central storehouse where, so far as practicable, supplies are received, inspected and stored for use and distribution; third, local storekeepers in charge of material at shops and elsewhere.

Requisitions should be made on the official in charge at the general storehouse. He fills them from supplies on hand, if possible. Whenever supplies are needed to replenish the stock of the company, he makes a requisition on the purchasing agent.

However, the accompanying rules and regulations are not dependent for their value upon any particular organization; I merely outline an organization I know to be effective.

Attention is called to the form of the requisition.* It gives the amount required, the amount on hand, and the amount that has been ordered but not received. It places in the hands of the general storekeeper and purchasing agent the information necessary to enable them to act intelligently and quickly. This last is very important, as it may be assumed, without argument, that those who make requisitions for material, if not assured that their orders will be filled quickly, will keep a large surplus on hand to meet such a contingency.

The title of Storekeeper is general; it represents properly all who have charge of the supplies of a company at the shops and along the line, or who render returns thereof. It also covers those who keep the time of men and render account thereof. Upon some roads the storekeeper will be the official immediately in charge of a storehouse or the person having charge of the time of men; upon another he will be a master mechanic, upon another a division superintendent, roadmaster, civil engineer, purchasing agent, manager, and so on. So that when the title is used it may mean any one of these officials or all of them together.]

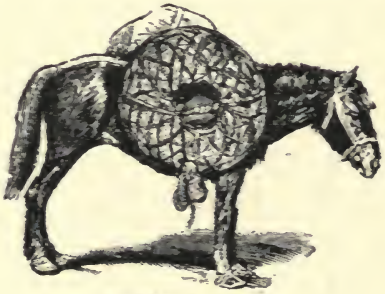
*See Form No. 1, Appendix.

PRINCIPLES GOVERNING REQUISITIONS.

Upon the efficiency of the rules and regulations governing requisitions depends the difference between economy and extravagance; between order and disorder.

The good of a service will be greatly enhanced if those concerned can be led to interest themselves actively and intelligently in the work.

If all who handle requisitions can be induced to exercise prudence, diligence and intelligence,



Carriage in Japan.

the most satisfactory results will be attained. But if any considerable number fails to do this, improvidence and waste will follow.

Particular officials can not supply a lack of interest among subordinates.

A railroad is too big for one man to watch even in a limited department.

There must be general interest.

A manager is able to protect the affairs entrusted to him to the extent that he can enlist the hearty co-operation of those about him.

This co-operation is to be attained, first, by selecting good men, and second, by wisely governing and trusting them.

The practices of railroads differ widely in regard to their methods of handling requisitions. Upon one line the requisitions of superintendents, master mechanics and others will be made on a general storekeeper, who honors them, if in his judgment proper, without further approval. If he thinks them unnecessary, wasteful or extravagant, he refers them to the proper officer for his action. It is a merit of the plan that it ensures the prompt filling of requisitions. This is of the utmost importance. Officials knowing that their requisitions will be promptly filled cut them down as much as they can. They feel that the responsibility is a personal one and endeavor to meet it fully. When, however, their requisitions are subjected to long delays and the scrutiny of so called experts before being honored, the case is different; the responsibility is then transferred to some one else; they are, therefore, less provident; they habitually make requisitions in excess of needs to meet possible reductions and probable delays. The responsibility having been placed upon others, they thrust it from them. While not disloyal, they act as irresponsible people do in every walk of life.

I have found it best that the requisitions of master mechanics, superintendents, civil engineers and other trustworthy local officers be hon-

Carriage in Morocco.

ored as soon as received. Afterward these requisitions may be subjected to the most careful analysis by the general manager and purchasing agent. If it turns out eventually that improvidence or poor judgment has been exercised in making requisitions, the delinquent may be reproved. If reproof is unavailing, he may be dismissed. Where the local official is a capable man, trusting him will make him better, and it is impossible to tell what he is until he has been trusted. In any event, momentary excesses on his part are as nothing compared with those he will commit if he knows that his requisitions will not be honored promptly, and that through this failure his work may be seriously crippled. Wherever such uncertainty exists, he will strive to provide against it by keeping on hand a much larger supply of material than he would think of doing if promptness and definiteness were the rule.*

Some companies will not allow the requisition of a superintendent, master mechanic, roadmaster, etc., to be filled until it has been scrutinized and approved by one or more general officers. This requires time, and if the approving officer

* The reader will notice that I continually return to this particular phase of the subject of supplies; to the fact that if requests are not filled promptly, or if they are not filled as called for and prompt notice of the fact returned to the person making them, the result will be to swell the amount of material that storekeepers will keep on hand. Local operating officers will not run the risk (even if their superiors are willing to) of being left without supplies to work with.

is absent or in doubt, the order lies on his desk for days, perhaps weeks, without action. Such delays are not matters of infrequent, but constant, occurrence. The result is most disastrous. In every case the approving officer is more or less ignorant of the local situation. But he is zealous, and in his zeal to prevent waste or extravagance he hesitates, or cuts down the requisition. The result of this procrastina-

Carriage in Ireland.

tion and uncertainty is most unfortunate, as I have already pointed out; it compels those who use material to keep on hand a larger supply than they otherwise would. This is demoralizing to the service, and adds otherwise greatly to its cost.

It has been the experience of companies that have abandoned the practice of requiring requisitions to run the gauntlet of general officers

before being honored that such abandonment tended to secure greater care and economy upon the part of local officers in ordering; that it increased their sense of responsibility. Examinations made by general officers are at best only superficial. They create a false situation by building up responsibilities that can not be sustained or intelligently enforced. The effect is to break down the *esprit de corps* of a service.

The time and place to enforce economy in the supply of material is when requisition is made on the purchasing agent to buy material; not when material is required for use. A master mechanic or superintendent that can not be trusted to order supplies from a storehouse is unfit for his place.

The attempt of general officers to exercise personal surveillance over supplies retards business and heightens expense. Of this there can be no doubt. It creates delay and uncertainty; fatal elements in business affairs.

Supervision is all the more effective when enforced indirectly. It makes men self reliant and trustworthy, and no road can be operated efficiently without such men.

Responsible, capable, self respecting officers can be made only by trusting men.

The foregoing covers generally a plan that I have found to work well in keeping down the supply of material and otherwise heightening the efficiency of the service. It is very simple. It cuts off all unnecessary circumlocution and

fastens responsibility upon those officials who are familiar with the local wants of the property. The trouble with most systems of handling material is that they take too little account of the intelligence, interest and practical experience of local operating officers, whereas they are the only officers who really know anything

Carriage in Tartary.

about minute wants. Their responsibility and interest require to be heightened in every possible way, not deadened.

In reference to details, I would recommend:

First, that every act affecting the procurement or use of material should have the concurrent knowledge and sanction of at least two independent departments.

Second, that all material should be bought by an official designated to perform the duty.

Third, that all material that may be sold should be disposed of in like manner.

Fourth, that the right to order material should be restricted to certain operating officers of the company having practical knowledge of the needs of the service.

Fifth, that the receipt, inspection, care and disbursement of material should be entrusted to storekeepers under the instructions of a general officer of the company.

Sixth, that the principal storekeeper should be designated a general storekeeper and that all requisitions for material should be sent to him.

Seventh, that it should be the duty of the general storekeeper to make one requisition each month for all material that is required to be bought, such requisition to be approved by the general superintendent or general manager, or both.

Eighth, that so far as possible the supplies of a company held in reserve for operating and other purposes should be kept at a general storehouse in charge of a general storekeeper, so that only he need provide against the delays and vicissitudes that attend the purchase and delivery of material.

The effect of this concentration, coupled with the knowledge on the part of storekeepers that their orders will be filled without delay, will

keep down the supply of material on hand to the minimum.

The efficiency of the service may further be enhanced by employing an inspector to visit periodically the various supply depots of a company to see that proper care is exercised in inspecting, storing and disbursing, and that no more material is kept on hand than is needed.

Carriage in Ireland.

In conclusion it may be said that no road can be operated either wisely or economically that does not take adequate measures to keep its store of material on hand as small as possible. In order to do this it is necessary to so simplify the question of the procurement of material that all who use it may know exactly what to expect.

RULES AND REGULATIONS GOVERNING REQUISITIONS AND ORDERS.*

Material should not be ordered in excess of the amount necessary to operate efficiently and economically.

Supplies should not be piled up to avoid making requisitions or to meet contingencies that may never arise.

Requisitions and orders should state the amount of material on hand, the amount ordered but not received, and the additional amount required.

Requisitions for material for shop storehouses should be signed by the storekeeper and countersigned by the master mechanic or operating officer in charge.

Requisitions for material for tracks, bridges, buildings and similar purposes along the line should be certified to by the storekeeper in general charge of such material and countersigned by the responsible officer in charge.†

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* Requests for material to be purchased or manufactured are properly called "REQUISITIONS." (See Form No. 1, Appendix.) Requests for material to be taken from store are properly called "ORDERS." (See Form No. 2, Appendix.) These distinctions, however, can not always be observed in the rules and regulations.

† To keep down the supply to the lowest possible limit, it is suggested that the roadmaster compile lists of tools and materials required to be kept on hand on each section, based on the standard of excellence which it is determined to maintain. This will vary on different parts of a road, but the lists should be as nearly uniform and as small as possible. The supply should be reduced on the sections as experience proves its expediency. Each section foreman should be given a copy of the list of tools and materials which he is required to carry, with instructions to renew his supply from month to month as necessary. At designated points on the road a duplicate of each pattern of frog and switch and a stock of other material in common use should be stored; they should be so placed that they may be readily loaded on passenger trains when required; this stock should be as small as possible to meet the needs of the service in cases of emergency. An article taken from the stock should be replaced at once. A rule requiring the return of material not needed, and that scrap be collected promptly and forwarded in due course, should also be observed. Requests for material should be made monthly by track foremen on the proper officer, as in other cases; the latter should examine and consolidate these requests.

Carriage in Morocco.

In order to prevent excessive requisitions and the duplication of material, supplies should, so far as practicable, be kept at the general storehouse.*

Local storehouses along the line should only keep on hand such material as is needed to meet immediate wants—say a month's supply.

In order to concentrate purchases, and for other important reasons, requisitions should, so far as practicable, be restricted to one a month. If, however, because of omissions, or for other causes, further supplies are required, they should be ordered as needed.

Requisitions on the general storekeeper should reach him promptly so that abundance of time may be given him to examine into the wants of the company before making the monthly requisition on the purchasing agent.

The general storekeeper should direct local storekeepers when to make their requisitions. It is not in every case desirable that requisitions should be made on the same date, or should reach the general storekeeper simultaneously.

After the requests for the month have been received and examined, a requisition should be made for such supplies as it is necessary to buy. This requisition should be carefully scrutinized by the proper officers to prevent purchases that are unnecessary or improper; also for the purpose of restricting them to particular kinds of material. It is at this point that supervision is most valuable to a company; to restrict purchases to such kind and quantity of material as may be desirable. After material is bought, the local officers of a company may very well be entrusted with the duty of using it without further supervision.

After a requisition to buy material has been examined by the final approving officer, it should be certified by him to the purchasing agent with such directions as the circumstances of the case demand.

If it is desired to have an article manufactured at the company's shops, a requisition should be made therefor, the same as

* In the event a company does not have a general storekeeper, the accompanying rules and regulations, so far as they specifically name him, are of course out of place. The officer, however, to whom requisitions are sent will take his place; that being understood, the rules and regulations will fit any situation and apply to any road.

if the material were to be bought. Exception to this rule may be made when an article is required to meet a pressing emergency. In such a case approval may be obtained subsequently or dispensed with entirely, as may be thought best.

Requisitions and orders should, so far as possible, be filled from the supply on hand, or by transfer from one storehouse to another.*

Requests for material should have the immediate attention of every one into whose hands they pass, and, when finally ap-

Carriage in Uruguay.

proved, the utmost celerity consistent with good business usage should be exercised in furnishing the supplies.

In order to ensure the maximum promptness and efficiency an order book should be kept at each storehouse, giving the history

* It will sometimes occur that while requests may be filled from the supply on hand, it will require that the material should be transported into a neighborhood where it can be bought to good advantage. In such cases it may be desirable to buy the supply at the place where needed. Facts like these require to be carefully considered and acted upon in every case in transferring material, and in making and filling requisitions.

of each request received, namely, where from, what for, date received, date filled, cause of any delay and other particulars.

In the event a request of any kind is altered, amended, cancelled, or action withheld, immediate notice of the fact should be sent to the person from whom it was received, giving the reason; the intent being that every person interested shall be promptly advised, so that they may act intelligently.*

In order to facilitate the procurement of supplies at points most convenient, requisitions should state, when practicable, where the material is to be used.† To prevent rehandling material in car lots it should be sent directly where needed, if practicable to receive and inspect it at such point.

In order to prevent confusion or misunderstanding, orders for the transfer of material, including scrap,‡ from one storehouse to another should be made by or through the general storekeeper.

In the event a local storekeeper or official orders material transferred from one depot of supply to another to meet an emergency, notice of the fact should be sent the general storekeeper.

It is the duty of those who have charge of such matters to see that storekeepers are kept promptly advised of all changes in materials, patterns or designs, or anticipated changes, so that requisitions and orders may be made to conform thereto and also so as to prevent an accumulation of material for which there may not be any future demand.

Notice should be sent to the general storekeeper of material ordered by him but shipped elsewhere.

Subordinates in charge of material at storehouses should keep advised of the supply on hand and promptly notify the storekeeper of any surplus or deficiency.

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* Neglect to carry out this rule will be unfortunate on many accounts. In order to prevent the piling up of material on a road it is necessary, as I have already intimated, that every person in charge should feel that his orders will be instantly filled or that he will be advised. If he has reason to suppose that there will be any delay or uncertainty, he will keep on hand a supply sufficient to cover the contingency of such delay. The unnecessary accumulations of a company may, therefore, be measured by the delay and uncertainty that occur in the filling of requests.

† The articles covered by this rule will not be numerous; they will be of the more bulky order.

‡ Old or wornout material.

Carriage in Constantinople.

In order to enable storekeepers the better to observe the disposition of supplies and to afford them a basis upon which to compile their monthly requisitions, they should keep a stock book in which they should record the quantity on hand of each kind of material, the quantity previously ordered but not received, and the quantity to be ordered in their next requisition. The stock book should be written up just before rendering the monthly requisition.

Returns of material on hand should be carefully scanned. The form of requisition affords an inventory of such material. The information is intended to aid in reducing requests to the minimum.

To further this last named purpose, and for other reasons, storekeepers should send their stock books with their monthly requisitions. By examining and comparing the requisition and stock book, the general storekeeper will be aided in disposing of the former. Possession of the stock book will also enable him to inform himself as to different kinds of material on hand, condition, quantity, etc. If the amount is excessive in any instance, he should make such disposition of it as the good of the service requires. It will also enable him to keep track of old material, material no longer in use and other supplies requiring disposition. It will be seen from this, therefore, that the stock book should be carefully written up so as to afford a full record of material of every kind on hand.

In addition to this, and in order to render the work complete, the general storekeeper or his assistant should at frequent intervals visit the different storehouses and supply depots of the company, and by personal investigation on the spot keep himself advised of the practical aspects of the case in each instance. Personal examinations of this character, attended by full and free conferences with local storekeepers, master mechanics, superintendents and others who order, care for or use material and fuel, will secure unity of action and understanding of the subject all around.

As soon as the general storekeeper has examined a stock book he should return it. The examination should be made within five days of its receipt.

In the event it is necessary to buy material to meet a pressing emergency, in other than the usual manner upon requisition, a request covering the same should be returned to the general storekeeper by the officer making the purchase, and the fact that

the goods have been bought noted on the face thereof; also the account to which the material is to be charged. The bill of the goods thus bought should accompany the request. The general storekeeper should forward the papers to the purchasing agent, by whom the voucher will be made.*

Carriage in Abyssinia.

But no material should be bought save by the purchasing agent, in due course of business, upon requisitions properly made, except in pressing emergencies that can not be foreseen or

* The general storekeeper should also make requisition covering the material thus bought, sending it with the bill to headquarters.

guarded against, where the interests of the company would suffer by delay.

Should an emergency occur requiring the purchasing agent to buy material without a requisition, he should forthwith notify the general storekeeper of the fact so that the latter may make a requisition to cover the same. The general storekeeper should note on such requisitions, "Already bought by the purchasing agent."

Requests for material should not be made by telegraph except in urgent cases. When it is necessary, the telegram should be signed by the persons who would in the ordinary course of business have signed the request. A requisition or order, as the case requires, should then be made and forwarded without delay. Across the face of such document should be written, "Ordered by telegraph."

Orders of foremen and others for supplies for current use should be restricted to immediate wants, as material can be more effectively protected in store than elsewhere. Only such material, therefore, as is necessary in the actual progress of work should be given out.

Material disbursed for a particular purpose and not used therefor should be at once returned or accounted for.

Requisitions for material covering a considerable period of time, such as rails, ties, posts and timber, should be accompanied by such statements and explanations as may be necessary to enlighten the management.

A record should be retained of each requisition by the person making it.

Material should not be drawn from store except upon a written order made by or under the authority of the operating officer in charge.

Orders should be dated, and should specify in detail the articles required, quantity thereof, where needed, and the purpose for which needed.

Orders should be carefully scrutinized, and in the event they seem to be wrong, should be investigated before being honored.

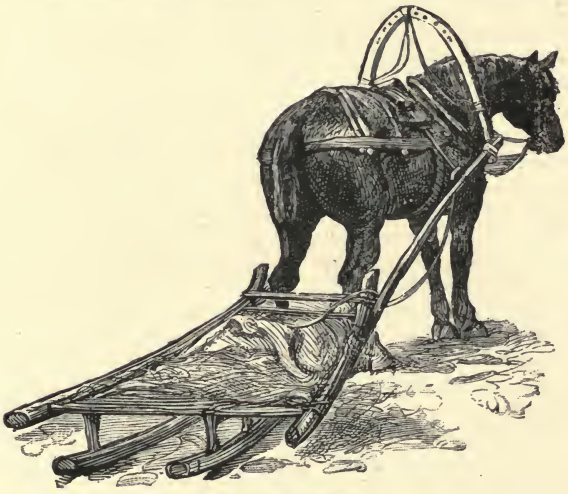
The ordinary form of order may be conveniently used in ordering brasses and tools. It should give the list of articles, the number of each on hand, the number required, and the number returned.*

*See Form No. 2, Appendix. Brasses and other implements no longer fit for use should be returned to the storekeeper when others are ordered to replace them.

As the orders afford, in the majority of cases, the most convenient means the storekeeper has of writing up the accounts. the price of each article should be noted thereon by the person filling the request.

Requisitions and orders should be preserved and filed away from day to day as filled. They are the authenticated vouchers upon which action is based, and without which it would not be proper.

RAILS, TIES AND EQUIPMENT.—As the purchase of these supplies involves a large expenditure of money. relatively, their



Carriage in Russia.

procurement is made a matter of especial moment by the management. Rules and regulations governing other material apply only generally here—except that purchases will be made only by the proper officials upon duly approved requisitions.*

FUEL.—The peculiar circumstances that attend the procurement, storage and use of fuel suggest the necessity of particular provision being made for supplies of this kind.

*The goods should be invoiced, as in other cases, to the storekeeper in charge. It is his duty to inspect the same and bring them upon the books.

Upon some roads fuel is ordered by operating officers through the general storekeeper as in other cases; upon other lines it is ordered directly of the purchasing agent.

The importance to a company of not keeping on hand a greater quantity of fuel than is necessary is too apparent to need notice; the importance of not running short is equally clear.

Provision should be simple, definite and expeditious.

A very simple plan, and one that will be found to work effectively, will be to have those in charge of fuel along the line make weekly and monthly returns of receipts and disbursements so that the official in charge may know how much fuel has been ordered at each point, how much has been received, how much there is on hand, how much has been expended, how much is needed.

A system that will work well on one road will not always work equally well elsewhere. I shall not attempt, therefore, to formulate here an arbitrary plan. However, there should be the same co-operation and accord between the purchasing agent and the official who keeps the fuel accounts that there is between the purchasing agent and the general storekeeper, co-operation at once hearty, sympathetic and effective.

Whatever the system of handling fuel may be, returns will be required of fuel ordered, bought, delivered, and how used. These are fundamental.*

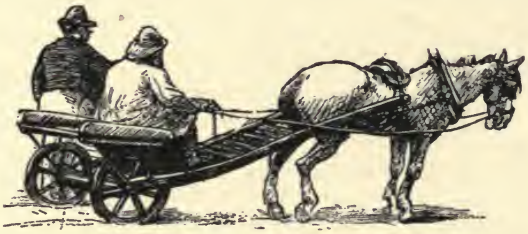
STATIONERY, BLANKS, BLANK BOOKS AND PRINTING.—The necessity of special provision for handling the stationery of a company is generally recognized by those familiar with the subject. Generally each company has what is called a stationery supply store where all blank books, forms and stationery are kept. This depot occupies the same relation to stationery that the general storehouse does to general supplies. Orders are made

* The following method of handling fuel has been tried and found to work well: Fuel for use in offices and upon trains is bought upon requisitions made by the superintendents. The stock of fuel for locomotives is kept up by the purchasing agent. His purchases are based on the returns from storehouses, made every ten days, of the amount received, consumed, and on hand. He gives directions as to the quantity to be sent to each storehouse. Bills for fuel showing car number, quantity, kind, etc., are sent by him to the general storekeeper to be examined and vouched for before being paid. The general storekeeper checks the bills against returns rendered by those in charge of the depots of supply.

upon it for whatever is required for current use. They are filled by the stationer without delay if esteemed proper and within reasonable bounds. The number of different kinds of books, forms and articles of stationery required to be kept in stock by a railway company can hardly be computed. Each one requires room for storage where it can be easily reached and properly guarded. The value to a company of a competent and trustworthy stationer can not be overestimated. He may save or waste a great deal without the fact ever being known.

So far as practicable the rules governing general requisitions should be applied to this branch of the service.

The following general directions may be advantageously followed. Requests should be sent directly to the stationer. But no new blank or form should be ordered by him without referring it for correction and alteration to the department in which it is to be used.



Carriage in Yarmouth.

Orders should, so far as possible, cover a month's supply.*

The stationer should decide as to the propriety of honoring orders in the absence of definite instructions to the contrary from the head of the department.

The stationer should make a requisition each month for material to be bought for the succeeding month. It should, so far as practicable, state the amount on hand. the amount ordered but not received, and the additional amount required. In emergencies, however, supplementary requisitions may be made.

In order to meet the special requirements of the service, material ordered by general officers should be bought upon their requisition without further approval.

* Upon some roads orders are required to cover a longer period.

The usual blank requisition should be used by officers in making requests for supplies required in this branch of the service. Agents and others should use the form specially provided.*

HOTEL SUPPLIES.—The peculiar character of the supplies used at dining stations and on hotel cars suggests especial provision. Many of the goods are of a perishable nature and all of such general use that particular provision should be made for their protection. When the general storehouse of a company is conveniently located, there is no reason why the hotel supplies should not be kept thereat; when this is not the case it will be necessary to establish a special depot for their storage so conveniently located that supplies may be procured in small quantities from day to day as needed.

The usual rules governing requisitions should, so far as possible, apply to this branch of the service.

Requests for supplies should be sent directly to the storekeeper in charge; such orders, however, should not be filled until approved by the operating officer in charge.†

The perishable nature of many articles used in the dining car department necessitates their being bought from day to day; requisitions must conform to these conditions. Outside of such articles, however, supplies should be bought in the usual manner.‡

The foregoing directions may be supplemented by brief details:

* Upon many lines a special form is provided for ordering station and office supplies; every form in use by the company is printed in consecutive order, from one upward. Each book, blank or envelope is given a distinctive number so that all that is necessary to do in ordering is to insert the amount required opposite the form number of the article needed. The supply on hand is required to be given; also the amount ordered and the amount actually received. Stationery required for use at stations may be conveniently and safely forwarded in boxes provided for the purpose, the boxes being promptly returned to the stationer. For form of stationer's requisition, see Form No. 1, Appendix.

† For convenience a special form is provided for making orders and requisitions, containing a printed list of the articles used and reciting such other particulars as the special requirements of this branch of the service demand. See Form No. 3, Appendix.

‡ In regard to supplies used at stock yards operated by railroad companies, reference is made to them in the volume on "Fiscal Affairs, Disbursements."

In order to ensure thoroughness, a record book should be kept at each storehouse of articles needed, so that nothing may be omitted when the time comes to make a requisition or order.

Requisitions and orders should be numbered consecutively, commencing with number one on the first of each fiscal year.

Storekeepers should keep themselves advised of present and prospective wants of the service by constant and familiar intercourse with operating officers; otherwise their requisitions and orders require to be supplemented by frequent and unnecessary requests.

Old or partially worn out material, and all other available substitutes consistent with the economical and effective working of the property, should be made use of in order to cut down requisitions and orders as much as possible.

Carriage in Rome.

No requisition or order should be made without first examining the supply of material on hand.

As a rule, a month's supply should be sufficient. The smaller the quantity on hand the less the deterioration and the less the cost of handling, watching and inventorying. It should not be forgotten, however, that the demoralization of the service and the extra cost entailed, occasioned by a short supply of material, is too great to warrant such a risk.

In making requests, due consideration should be given to the cost of handling, including packing, loading, unloading and accounting.

The material ordered should be such as is most consistent with intelligent economy and the avoidance of annoying circumstances.

In ordering, the distance from the source of supply, the facilities for storing and the nature of the material should be considered.

The foregoing details cover the more important rules and regulations relating to railway requisitions. They bring up, however, incidentally, all the multitudinous details connected with the handling of railway material. Some of these latter may be properly noticed here.

FURTHER PARTICULARS IN REGARD TO HANDLING MATERIAL.

It is the duty of the general storekeeper and officials who buy material to keep themselves advised of the stock on hand at the various storehouses.

When the purchasing agent buys material he should send a copy of the purchase order to the storekeeper so that the latter may anticipate the arrival of the goods.

It is the duty of those who buy material to solicit samples thereof, so that storekeepers may be able to determine whether the goods delivered are such as are bought.

The result of examinations of material made by chemists or others should be preserved and reported without delay to the general storekeeper for record in his office and transmission, if desired, to the purchasing agent or other officials.

In order to enable storekeepers to render due account of goods received and to charge same on their books according to prices paid, invoices should accompany material or be forwarded in advance thereof. There should be no delay in sending documents of this kind; their absence prevents proper inspection and due and necessary accounting.

No payment for material should be made without the written acknowledgment of the storekeeper that the property has been received, inspected and accepted.

The final disposition of scrap and material no longer in use should be looked after by an officer delegated to perform that duty.

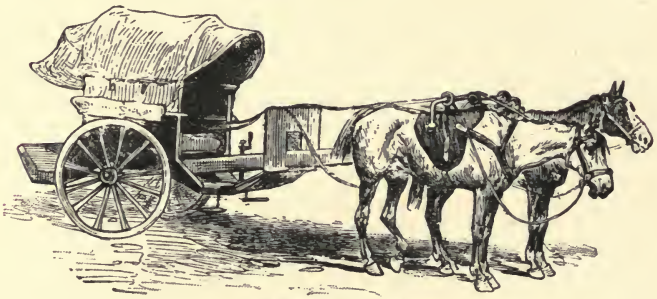
Notice of the sale or disposition of material in store should be sent to the storekeeper in charge, so that he may duly account therefor in his returns.*

In the event yearly or time contracts are made with manufacturers or others for particular classes of material, such as castings, car wheels, etc., the material may, when more convenient,

* I assume that old material, scrap, etc., is sold by the purchasing agent or some other officer.

be ordered from day to day, as needed, instead of monthly, as the rule requires in regard to other material. *

Notice should be sent by operating officers without delay to the general storekeeper of material that does not come within the requirements of the contract under which it was bought or which has failed to accomplish results guaranteed by the vendor. It is the duty of the general storekeeper in such cases to forthwith notify the proper official.



Carriage in India.

Material sent to shops to be repaired should be consigned to the storekeeper. The request should be signed the same as a requisition. It is the duty of the storekeeper, upon the receipt of the order, to see that no delay attends its execution; that the foreman or official whose duty it is to give the matter attention is notified, and that the article reaches him without delay and, when repaired, is forthwith reshipped. It is the duty of all concerned to see that prompt disposition is made of matters of this kind.

* It should be ordered at such times and in such quantities as the interest of the company requires.

CHAPTER VIII.

INSPECTING, RECEIVING AND CLASSIFYING SUPPLIES.

The importance of inspecting material properly is apparent. It is not enough that supplies are bought judiciously. Intelligent measures must be taken to see that what is bought is received. The duty of inspecting the material of a railroad requires accuracy, intelligence, and a technical knowledge of the thing inspected. These are not to be found in any one man. Different inspectors will be required, possessing particular knowledge of the thing they inspect. They must be men of a high order of integrity, and of a disposition that can not be inveigled into describing a thing otherwise than as it is. These qualities are not rare among the employes of railroads, and capable inspectors are not difficult to find, but the qualifications needed must be kept in mind in making selections.

The clashing that is inevitable between seller and buyer as regards quantity and quality of goods delivered is greatly lessened when the office of inspector is worthily filled. He has the confidence of those with whom he deals. They accept his statements. He, however, none the less avails himself of every incident connected with his duties that will enable him to convince the shipper of the accuracy of his inspection.

It can not be too strongly impressed upon inspectors that the good of their employer requires that they should be entirely fair in their work. A company's interest can never be advanced by attempts to defraud the seller. Honesty, in this as in everything else, is the only policy and should be the standard. A contrary course quickly creates suspicion, rendering merchants unwilling to sell on as favorable terms as they otherwise would; they will take measures to protect them-

Carriage in Chile.

selves, and will offset the dishonesty of the inspector by unfair means in other directions; quite likely by bribing the inspector himself. Indeed, such attempts may be made without any precipitating cause, but they are not so likely to occur if the company is fair and the inspector straightforward.

The danger, however, that inspectors may be improperly influenced, requires that the greatest care should be taken in selecting them, and in governing them afterward.

Venality in the purchase of supplies not only involves payment for inferior goods, but for goods never delivered. The former is worse than the latter. It is more difficult to detect and involves a chain of disastrous consequences. Thus, by the receipt of an article of oil inferior to that purchased, a company is not only swindled as regards price, but its use injures the machinery, and perhaps precipitates an accident to the great pecuniary loss of the company.

These things may not occur, but prudence requires that provision should be made to prevent them; the most effective measure is the exercise of good judgment in selecting inspectors and their systematic government afterward.

It may be set down as a fact not to be disputed that an inspector who will defraud a seller will also defraud his employer if he can derive benefit therefrom.

The disposition of men to seek opportunity to do an unjust thing on behalf of their employers may be accepted as an evidence of instability.

The safety of corporations depends upon the just action of their servants, and whenever one of them construes it to be his duty to lie or cheat on behalf of his employer, he will, with equal facility, lie or cheat in his own behalf if occasion arises. His virtue will not be able to resist the first onslaught, and his seduction and abandonment are only a question of days or weeks.

The duty of inspecting railway supplies should be performed with the same intelligence and care that it would if the thing inspected were owned by the inspector.

There can be no higher standard than this.

The inspectors must be honest, experienced, discerning, men of resolute character. Their experience and talent must be commensurate with their work. They must be able to resist insidious attentions and flattery as well as open bribery.

Carriage in Saxony, A. D. 1584.

They must be sufficiently skilled to be able to judge of the qualifying clauses that attach to the material they inspect.*

Inspectors will be variously tempted. It will not do for them to place themselves under obligation to those with whom they deal; to sub-

* Thus a knot hole may not be objectionable in a tie if not located under the rail; shrinkage in the face of the tie that might not be objectionable in one place would make it unfit for use in another. They must understand the peculiarities of timber embraced or implied under the heads of shakes, wains, cracks, splits and other attendant conditions; the peculiarities of metals, varnishes, oils, paints, fuel, etc.

ject themselves to suspicion is fatal to their usefulness.

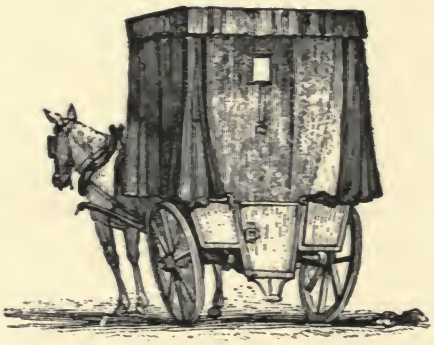
The duties of inspectors of track material, timber, fuel and kindred supplies are usually arduous and perplexing; they must be hardy of frame and thoroughly skilled. It is said that there never were two ties or pieces of wood exactly alike. Inspectors must constantly possess a thorough knowledge of such material and the use it is to be put to in order to inspect it accurately; to be able to judge rapidly and correctly as to its class and disposition, and to detect at a glance the tricks of dealers.

They must be men of strong character with confidence in themselves; even tempered, sober and fearless, doing what is just to the buyer as well as to the seller; what is just and fair as between man and man.

As regards details of inspection generally, if material is deficient in any way either as regards quantity or quality, the fact should be entered on the invoice; or if this document is not at hand, the particulars should be noted elsewhere with a view to their final insertion on the invoice.

The practice observed when material does not conform to the purchase is not uniform. In some cases it is returned; in others it is held to await further correspondence. Sometimes such use is made of it as the exigencies of the service allow. The only safe course is to insist upon the delivery of that which is bought; any other entails confusion and possible loss. Circumstances

will, however, arise where articles will be delivered unintentionally by the seller that do not meet the requirements of the purchase, that can be used in some other way without detriment. In cases of the kind they should be laid aside and the facts reported to the proper official for decision. If favorable, the exact nature of the material should be noted and the record book and the invoice made to conform thereto.



Carriage in Ireland.

A large proportion of the material that is bought requires that a sample should be sent to the storekeeper, to enable him to inspect it intelligently. This practice should be observed. It is only by such a course that sellers can be held to a rigid accountability. The great difference in the kind of goods furnished by different men, or the same men at different times, renders accurate inspection impossible without samples.

While care is always required to be exercised in inspecting and receiving material, it is manifest that greater responsibility attaches when the material is received from a seller than when received from a company's storehouse. Mistakes or omissions in the former case may involve loss in many directions, and are certain to breed demoralization if not discovered and corrected, whereas if the material is simply transferred, the circumstances attending its receipt and inspection are not so important. However, efficiency will be promoted if the work is intelligently and methodically performed in all cases and all discrepancies carefully noted and reported.

In receiving goods it is desirable, where the name of the manufacturer or seller is not plainly branded on the article, that some mark shall be placed thereon that will facilitate its identification afterward, in the event it should prove to be defective or otherwise than as agreed upon. In the case of round iron, this may be done by painting the end or a portion thereof with some distinctive color. It will never be difficult for the storekeeper to find some simple and effective way to mark material, so that it may be afterward identified.

The practice of accepting material before it is unloaded is not a good one.

Material should be inspected in detail, as it is unloaded and placed in the storehouse. It will frequently be necessary for the inspector to ask

Carriage in Russia.

the advice of foremen and others having practical knowledge of the articles he receives. Judicious use of such information, in doubtful cases, can not but redound greatly to the efficiency of the work.*

Details in regard to inspecting material can only be generally referred to. Each class of material possesses characteristics peculiar to itself which must be taken into account by the inspector. To attempt to define the duties of the examiner in detail would, in many cases, require an accurate technical description of the article used—an absurd and impossible task. Moreover, the question as to whether an article comes up to standard can not in many cases be positively determined until after it has been used. This is so in regard to rails, car wheels, axles and similar material. To meet such cases a company must keep an account of the date of the receipt of material, when put into use, time in use, condition of use, and such other details as the case involves.

One or two practical illustrations of details connected with the purchase and inspection of material may be inserted here for illustration. Thus, the bids of a road for ties:

"All ties must be well and smoothly hewed or sawed out of sound, straight, thrifty timber; must be eight feet long, exclusive of the kerf; must be uniformly six inches thick between the

* It has been suggested that where a company's supplies are not delivered at the storehouse, it should have a room in charge of a storekeeper so as to facilitate inspection under the eye of both seller and purchaser; a thing impossible when a company does not accept material until its arrival at an interior point.

faces; each face side to be six inches wide or upward at the narrowest place, inside the bark, and the faces to be straight, truly lined and parallel with each other. If ties are sawed or split from large timber they must not be less than eight inches wide on face side, and free from wane, shakes or unsoundness of any kind. The ties to be delivered on ground at or above the grade of the railway track, and within thirty feet of same, subject to the inspection and count of the purchasing agent, or any authorized agent of the company, whose action in counting and receiving or rejecting the ties offered shall be final and conclusive; inspection will be made once a month, or oftener if required, and payments will follow within thirty days thereafter; station agents will furnish, upon application, the necessary blanks for making proposals. All persons desirous of furnishing ties on the above named terms and conditions will make application through the

Carriage in England, A. D. 1829.

inspector, who will issue permits; no person will be allowed to place any material on the right of way of the company without special permit to do so."

And for wood:

"All cord wood to be well manufactured out of sound, straight, thrifty timber; to be cut four feet in length, measuring half the kerf, to be well corded in single or double ranks, six feet or eight feet high, the ranks not to be over two hundred feet in length, a space to be left at the end of each rank of at least eight feet before commencing another pile; the wood to be piled on longitudinal sticks sufficient to keep it from the ground, and in all cases to be piled on the ground at or above the grade of the railway track; the end of each rank to be substantially stayed by a good abutment; a space three feet wide to be left between the ranks, if piled in single ranks, or the same space between

every two double ranks, if piled in double ranks, so that a man may pass conveniently through for the purpose of inspecting and measuring the same; no round wood to be delivered that is more than six inches in diameter, or less than three, and no split wood that exceeds nine inches in greatest through measurement; no wood to be piled within one hundred feet of a crossing. The said wood to be delivered subject to the inspection and measurement of the purchasing agent or any other agent of the company duly authorized to inspect and measure the same. The decision of the said purchasing or other authorized agent, in regard to the inspection and acceptance of the wood delivered, and the measurement of the same, or in regard to the rejection of the whole, or any part thereof, for non-compliance with these specifications, shall be final and conclusive. Hard and soft woods must be piled separately. Measurements will be made monthly, and, until measured, the wood will remain at the risk of the owner."*

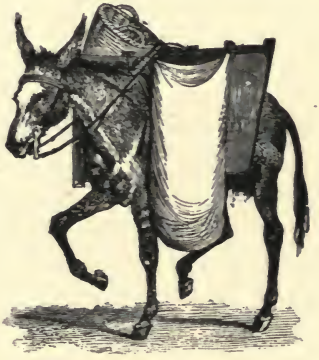
There are different methods of accounting for material received. One is to enter the material item by item on a blotter as it is unloaded. Afterward this is compared with the invoice. One purpose is to prevent collusion, though it is not quite apparent how this is accomplished. If it is the desire of the inspector to report more material than is received, or material of a different kind, it is not necessary that he should have the invoice before him.

In receiving merchandise at stations, consigned to merchants and others, the goods are compared item by item with the way bills as they are unloaded from the car and all marks and references to excesses, deficiencies, damages, etc., noted. This practice has been found to work well, and it would seem to be a safe plan to follow in receiving material, except that the invoices are used instead of the way bills.

* Railway companies usually have special inspectors for ties, fuel, etc.

Discrepancies are more likely to be noticed, and accurate account taken thereof, if goods are compared with the invoice as received and tally marks and notations indelibly marked thereon at the time; the number of the car and date received should also be inserted.

If the invoice has not come to hand when the material is received the record of the requisition may be used. There should be entered on this



Carriage in Lima.

record the date of receipt of goods, the number of car and the name of the party from whom bought. Afterward, when the invoice has come to hand and been receipted and returned, the fact should be noted on the record. All these details should be inserted on the record in any event. They will prevent the certification of duplicate invoices and other irregularities.

The absence of the notations on a record, moreover, will be an indication at all times that the

material has not been received, or has not been invoiced.

The use of original sources of information of this kind saves clerical labor and avoids dangers likely to occur when copies are used.

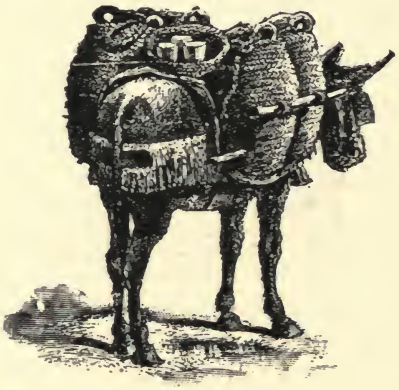
Too great care can not be exercised to surround the recording and singing of the invoice with proper safeguards, as this instrument forms the basis of the voucher used in paying for the goods. I would not only note the particulars of the invoice and the signing thereof, as described above, but also further record the fact in the Material Book, thus rendering it doubly impossible to sign unwittingly a duplicate invoice.

I also attach great importance to the use of the original invoice in receiving and inspecting goods. Its possession enables the inspector to devote his whole time to the examination of the goods, whereas, this duty becomes much clouded and in many instances of secondary importance if he must at the same time perform the clerical work of entering the details of the goods in a blotter as he receives and inspects them.

The value of the invoice to the inspector renders it important that it should reach him at least as soon as the goods; no delay should occur in forwarding it. It should be made on or before the loading of the goods for shipment, and should be sent forward forthwith by passenger train. Its receipt by the consignee is thus assured simultaneously with or before the arrival of the goods. In the event the invoice is not received in time

for use in receiving and inspecting the material, the details of the latter should be entered in the blotter and Material Book, of which record notice should be inserted on the requisition record as pointed out.

To facilitate the receipt of material at points away from storehouses, the original invoice should be sent to the place where the material is to be



Carriage in the Alhambra.

delivered, so that it may be used in inspecting and receiving as in other cases. A duplicate should be sent to the storekeeper against whom the material is to be charged. When the original is thus forwarded for use in inspecting, there will be no necessity for a memorandum book being kept at the point of delivery. It must be impressed upon the foremen and others receiving material under the circumstances named, that

the utmost care must be observed in inspecting and counting, as imposition is much more likely to be practiced under such circumstances than in other cases.

In the purchase of material, invoices should precede delivery, as pointed out, so that they may be made available in inspecting and checking.

Invoices, and reports upon which payments are based, should be carefully labeled and filed away for convenient reference or attached to the cash voucher.

While material must be personally inspected in every instance, it is only by comparisons frequently, that its nature can be determined. The method of comparison is suggested by the article. Thus, different varnishes and paints may be placed side by side on the same structure. Such comparisons are simple and effective. There can be no escape from their conclusions.

Each day the work of inspecting railway supplies is being simplified by the use of laboratories and other devices. They not only prevent imposition being practiced, but relieve operating officers of much mechanical work that at one time devolved upon them. In the early history of railways superintendents and others were called upon continually to decide scientific questions without preparatory knowledge. It is needless to say that their decisions were uncertain and unsatisfactory. The organization of testing laboratories has measurably relieved them. Speaking of the duties and value of this new departure, a

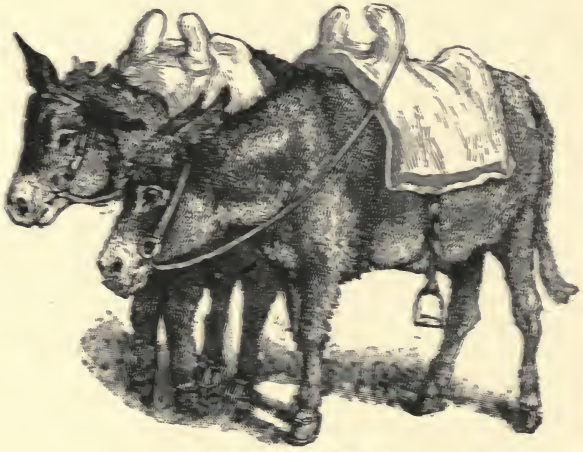
Carriage in Rural England.

committee of master mechanics, selected to consider the subject, say:*

"The organization and conduct of a laboratory for testing material is one of the most delicate specialties connected with railway work, and it is possibly owing to this fact that the growth of the testing department idea has been slow. The degree of benefit to be derived from the department depends directly upon the ability both in theory and practice of the men put in charge. Since the investigations required are both chemical and physical, scientific and practical, it will be seen that the chief must be somewhat versed in all these branches. It is not desirable that he should be a specialist, but rather a man with good theoretical and practical education, trained to accurate reasoning and of sound judgment; he should have had broad experience and be able to generalize from the reports of his subordinates in such a shape that his statements will relieve his superior officers from the necessity of going into details. He must be able to plan methods of testing and experimenting and see that they are properly carried out. . . . Much valuable time has been frittered away in testing laboratories by the practice of taking up work, which would, of necessity, not give satissactory practical results, or which, when obtained, are insignificant in value to that of the time wasted in arriving at them. . . . A list of the subjects which can, in our opinion, be profitably undertaken and which will produce results of practical value, embrace: First, routine—physical and chemical work; testing shipments of material kept in stock and bought under definite requirements; second, special work—such as tests of the efficiency of machines, fuels, improvements in mechanical construction and patented devices (whether conducted on the road in actual trial or in laboratory); trials of water purification; tie preservation methods, and others. In the field of 'special work' are embraced those subjects which admit of professional opinion without actual experiment, and for such the experts connected with the department draw upon their knowledge of the engineering practice of the day. . . . The first matter of importance which will engage the attention of the head of such a department is establishing

* Committee of Master Mechanics' Association composed of Messrs. George Gibbs, David L. Barnes, George W. West and L. S. Randolph.

standard specifications for material bought regularly and in quantity. It is a matter requiring the greatest delicacy and knowledge of all conditions in the use as well as the manufacture and market from which the supplies are drawn. . . . The first aim in framing specifications should be to obtain completely the requisite standard for quality, neither more nor less, and in so doing to encroach as little as possible upon the freedom of the purchasing department in obtaining as wide a market as practicable to buy in. . . . A careful study of the method of manufacture of a material will often suggest some simple means



Carriage in Rural England.

of compelling adherence to the best methods. After establishing the requirements thought necessary the views of the purchasing agent and the leading manufacturers should be obtained as to their practicability and influence upon market supply. A standard specification should in no sense be considered final, but must be subject to alteration from time to time as the market supply varies and as service reveals weak points. In receiving materials bought under specifications samples must be taken representing a certain definite percentage of shipment and acceptance made subject to sample under test. This percentage taken will vary with the nature of the material

and a consideration of the chances of error introduced. In buying under specifications the purchasing agent should maintain a close consulting relation with the testing department as to the uniformity and reliability of the material from different manufacturers. The head of such a department, keeping a close watch of the material under test and under all conditions of manufacture and use, should be able to draw valuable conclusions, to be obtained in no other way. The relations between the purchasing and testing (inspecting) departments of a railroad should be close and cordial."

The practices of English railways in regard to handling supplies are generally the same as in the United States. An officer known as the general stores superintendent ascertains the wants of the service and the best channels of supply. He negotiates the purchase of material and fuel; also the sale of old material. The terms and conditions of purchase or sale are submitted by him to a committee of the board of directors for its decision. When it approves the purchase or sale of material, he issues the order and sees that contracts are observed. Coal, coke and other supplies not subject to frequent fluctuations in price, are bought under contract. For convenience of storage and distribution, the material department is divided into four or more principal sections, namely, locomotive and carriage, traffic department, way and works department and stationery. The sections are further subdivided when necessary. When material is received it is carefully inspected by examiners as to condition, quality and price. It is then ticketed. The tickets show description of goods, from whom received, and price; the latter is in cipher.

Carriage in Palestine.

CHAPTER IX.

FACILITIES FOR AND METHODS OF HANDLING MATERIAL.

Proper care of material requires convenient arrangements and adequate provision against damage by the elements or removal without the knowledge of the storekeeper.

For reasons already explained, these provisions are lacking in many instances.

The fact that a railroad company must keep on hand a large quantity of material seems not to have been known, or if known not to have been regarded, by those who planned our railroads in the first instance. Thus we see fuel depots that can not be enclosed or guarded; repair shops without storehouses; storehouses that are too small and do not protect their contents, and so on.

Where room for storing new material is inadequate, provision for old material, we may readily suppose, is lacking.

Those who planned our first railroads did not appreciate the extent or value of a company's material, or regard the fact that its loss or waste directly influences the cost of operating. Not one drop of oil can be wasted, a spike rendered worthless, a pennyweight of iron allowed to go to waste, or an ounce of fuel misappropriated or subjected to depreciation, without adding to the cost

of operating. The extent of such losses, therefore, is the amount a company pays for such mistakes or neglect to correct them, where they admit of correction.

A storeroom should be secure, large, dry and well lighted. It should be so located that goods may be unloaded into it directly from the cars. The floor should be on a level with the car door. Storerooms should be fireproof and protected from frost and dampness.

Supplies should, so far as possible, be concentrated in one building, so that the supervision of the storekeeper may be easy and complete.

Provision should be sufficient to permit every article to have a place assigned it, so that its location may be known and easy of access.

If possible, the storehouse should be divided into sections, each section being lettered and the material catalogued. This will enable storekeepers to locate articles accurately and quickly and will insure their being kept where they belong. It will also enable inexperienced men to quickly learn the business. This last is important, as it is necessary from time to time to break in new men.

The more intelligent the provision that is made for the care of material, the greater the concentration and the smaller the stock carried. Concentration permits minute supervision and accurate information.

In regard to practical details connected with the storing of material, it is probable that the

devices of merchants (waiving the provision they make for purposes of display) will be found best adapted for use at railway storehouses. Thus, racks will be provided for different kinds of sheet and bar iron, located conveniently for use, and in such a manner that the contents may be

Carriage in Teheran.

determined at a glance; articles similar in appearance but differing in value and utility will be kept distinct;* oils, varnishes and other liquids will be kept in cans or tanks and so ar-

* The necessity of this is illustrated in the case of iron; that of a common quality being worth two cents per pound, while another kind, identical in *appearance*, is worth seven. Distinctions of this nature must be observed in storing.

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better than it is for wood, and the general substitution of coal for wood throughout the United States has been a means of great saving in many ways to railroad companies.

The facilities for handling and protecting coal, while not perfect, are much more complete than formerly. They admit of easy and economical loading and unloading, and in the majority of cases the storehouses are reasonably well pro-

Carriage in Peru.

tected from the weather and the depredations of thieves. However, it is probable from the great attention that is being given the subject, that we may expect substantial advance in this department of the service hereafter. The subject merits the painstaking thought of railway managers and engineers.

The care of material at the different storehouses should be entrusted to a local storekeeper.

He should have charge of the force employed. This concentration, while it will seem in some instances to add to the cost, will be more economical than any other method. Responsibility is greatly heightened by concentration. When the authority is diffused, there will always be more or less men handling material who will appear under some other head. It prevents accurate knowledge of cost and, consequently, engenders extravagance. Two men will be employed to do the work of one. Moreover, greater safeguards can be attained when the authority is concentrated than in other cases.

It is of great importance that disbursements should be cut down as much as possible; that material should not be taken without orders and without due necessity, and without being charged.

Wherever the amount of material in store is sufficient to occupy the attention of a man to receive, care for and disburse, there a storekeeper should be appointed. His pay should be commensurate with his duties. He should be known as the storekeeper, and should have the title.

A storehouse can not be located too near to those who use the supplies. Safeguards, however, must be adopted to prevent use without authority. The nearer material can be stored to those who use it, the less expense there is in going to and fro.

The due care of material requires that the amount in stock should he kept as small as possible.

Whenever there is anything on hand that is not needed, the fact should be immediately reported to the proper officer.

When the supply of an article is in excess of needs at a local storehouse, notice should be sent to the proper official with a view to having the surplus transferred to some place where it may be needed or otherwise disposed of.

The storekeeper's duty does not end with the delivery of material for use. He must follow it afterward, until it is consumed. He must take note of the manner in which it is consumed; must see that its use conforms to the original purpose, and that it is economically used.

The proper handling and economical use of material requires that the storekeeper should be something more than a drudge.

He must watch each article from the moment it comes into the possession of the company until it is worn out, and if, afterward, it has any value, it is his duty to see that the residuum is sold for what it is worth.

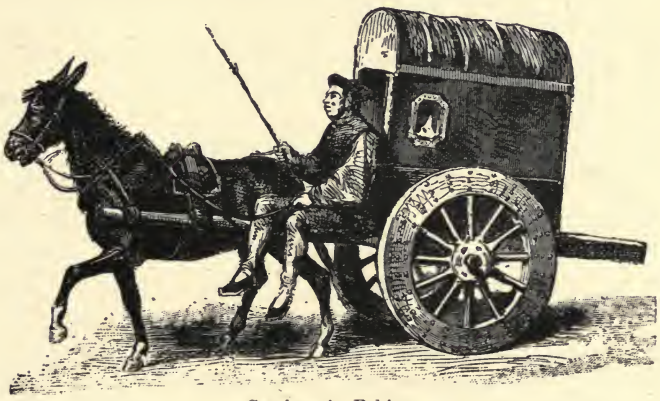
The storekeeper is required to be a man of affairs and must possess sufficient business talent and tact to command respect.

Where adequate provision is made for handling material, the duties of the storekeeper are greatly simplified. Where provision is lacking his duties are perplexing in the extreme. The latter situation is much the more common of the two.

Where facilities are inadequate, separate provision can not always be made for particular

articles; it is frequently necessary to pile the goods indiscriminately together. Storekeepers must endeavor, so far as possible, to make such disposition of the space allotted them as to avoid this. It prevents proper guardianship, and entails duplication of articles and undue depreciation.

Men are discreet and watchful according to their responsibilities.



Carriage in Pekin.

The wise use of material depends upon the care with which it is disbursed and looked after subsequently. Greater importance is attached to the completion of a work in progress at a particular time or in a particular manner by those concerned than in regard to cost. Only those who are responsible consider the latter.

The economical management of a property necessitates accurate exhibits of cost. The in-

formation, to be valuable, must be particular. It must take cognizance of minute subdivisions. A railroad can not be operated economically in any other way. It is immaterial whether the property be large or small; to be worked effectively and cheaply, its disbursements must be carefully analyzed and wisely curtailed.

A thousand miles of road may be guarded as well as a mile. But the supervision must be methodical, untiring and intelligent.

Charges against work in progress (whether it be a tin dipper or a locomotive) should be based on the work performed and the material used. This requires careful accounting; it requires that the storekeeper should charge the amount disbursed to the thing upon which disbursed at the time it is disbursed. To do this, he must know what material is used. This requires that he should have charge, and that such protection should be thrown around material as to prevent its being used unauthorizedly. The facilities for this are lacking in many places. But the more thoroughly the question is understood, the more skillful the use that will be made of the facilities we have.

With better understanding of the subject the better the provision that will be made for storing and handling material; the more convenient, ample and secure will be our storehouses.

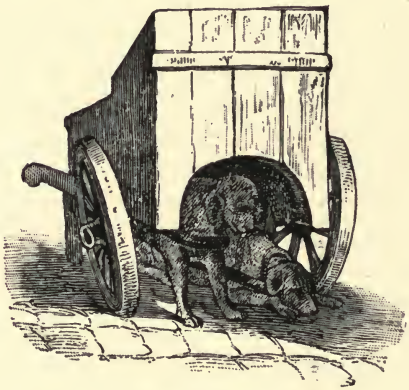
The subject invites the same forethought that the storage of engines and machinery and the preservation of merchandise receives.

The erection of storehouses for material and fuel should receive the same consideration as a machine shop, warehouse, elevator, office or station; a consideration that takes into account the uses to be made of it and locates it accordingly.

The mistakes of the past we are not responsible for, but they can be alleviated in many instances, and may be entirely avoided hereafter.

The care of material requires that provision should be made for preventing fires and for extinguishing them when they occur. The steps taken in this direction by the English roads fill a volume. Whether the risk justifies the expense is, however, doubtful. But the precautions they take minimize fires and lessen the risks that attend them. The practice upon many English roads is to organize a fire brigade, a small sum being allowed the members thereof by way of gratuity. Officers are appointed and each brigade is drilled at frequent intervals in its work. In case of fire, the official in attendance assumes command. Buildings are provided with appliances for extinguishing fires, and each member of the brigade is supplied with a book of regulations instructing him what to do, and furnishing him with a list of appliances in his district and noting their location. These instructions are too voluminous to be incorporated here. Where the devices of the English roads are impracticable, others more simple should be used. The best and most economical that suggests itself is the use of barrels filled with water

(with pails sunken therein) kept ready for use wherever material is stored. These, with the use of portable fire extinguishers, will afford very fair protection at small cost. The devices must, however, be carefully looked after from day to day and the force drilled in their use.



Carriage in Holland.

CHAPTER X.

CARE AND USE OF ROAD MATERIAL.

Much of the material of a railroad lies scattered along its track, away from the observation and care of storekeepers. It is always more or less of an unknown quantity. Its supervision and custody must be entrusted wholly to others; to men having, to them, more important duties to perform. Of this kind of material, that used in the track is the first I will notice.

The supplies required for the repair and maintenance of track are ordered by the various section foremen. These orders are sent to the inspector or roadmaster and by him forwarded to the officer agreed upon, who further passes upon them.

The limited facilities section foremen have for storing material renders it especially desirable to restrict the amount as much as possible. They need enough to meet current wants and extraordinary emergencies. They should, however, not carry over a month's supply, and in many cases their stock may be replenished oftener than thi .

Track supplies should be kept, with other material, at a central storehouse and should be sent from thence to the sections as needed.

There is no necessity for a separate supply depot for track or other material.*

The greater the concentration, the less the cost of handling, the greater the intelligence in disbursing, and the less the stock required to be carried.

Undue multiplication of storehouses should be carefully avoided.

Storehouses are required at the various centers where equipment and tools are repaired, but there is no necessity for more than one storehouse or one storekeeper at any particular point. If the storekeeper performs his duties, orders upon him will be filled with the same intelligence and promptness that they would if made upon a subordinate immediately responsible to the person ordering. If he does not so fill them, he is unfit. The remedy lies in his dismissal or admonition; not in the creation of another storehouse. It is just as proper to have two superintendents for a division, or two master mechanics at a shop, as to have two storekeepers at the same place. If there is more than one storehouse, one storekeeper should take charge of the whole, the others acting in subordination to him. Such concentration will permit the full utilization of the force and such concert of action in

* In construction work or where special gangs are employed, the person in charge should be held responsible for the return to the storehouse of all tools such as tamping and lining bars, etc. The fact that they are in use does not mean that they will be worthless when the work in hand is completed.

regard to the stock carried as to prevent unnecessary accumulations.

Material forwarded to a track section should be charged thereto, the same as if it were a storehouse. The storekeeper who has general charge of track supplies in the hands of foremen should open an account with each section; the debit to all the sections will make the total amount of material charged against him on the general books.

Carriage in the Harz Mountains.

Foremen of sections should acknowledge the receipt of material and make returns the same as other storekeepers; their returns should exhibit the amount received, amount used, for what purpose and amount on hand. Such a system of returns is easy to maintain.* It renders a thorough supervision of track supplies possible.

The lack of clerical skill upon the part of section foremen is so well known that it was the

* See book "Fiscal Affairs, Disbursements."

custom at one time not to require any returns from them of material received, used or on hand. It was assumed that they could not make a return and so the material sent them was charged directly to the operating or construction account, as the case might be. This was a very simple and expeditious way of getting it off the books and into the accounts, but it had a tendency to encourage wastefulness. The books did not show any material on hand. The result was general ignorance, extravagance and excessive accumulations.

The section foreman's lack of clerical skill is partly real, partly imaginary. An extended statement is difficult for many of them to make, but they can set down figures, and if the names of the articles are printed and they are only required to enter the amounts opposite in columns provided therefor, they can carry on a system of accounts that will answer very well for data for those at headquarters.

There are different methods of accounting for track material and labor. One was introduced by the writer several years ago and has worked very well. It does not contemplate any bookkeeping on the part of the section foremen. They are required to make returns of material received, used and on hand, and in regard to labor, of the hours worked, rate, and so on, the forms are printed and provide in a simple way for describing the work in hand.*

* See book "Fiscal Affairs, Disbursements."

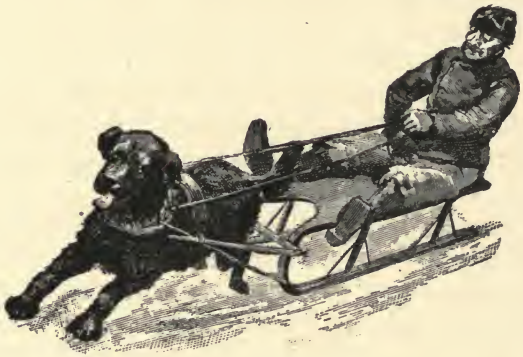
The disposition of those in charge of track to order more material than is needed it not greater than in other departments of the service. Nevertheless, economy will be increased by careful scrutiny of requisitions and returns.

The exigencies of the track department require that each section should be supplied with such tools and supplies as are necessary to meet ordinary and extraordinary emergencies; common repairs and renewals, and the exigencies of storms and accidents. This necessitates certain flexibility not necessary elsewhere. But the disposition to exaggerate, without knowing it, the wants that these special emergencies give rise to, will be apparent and must be met by attentive and careful oversight.

Track material requires to be constantly looked after. Tools and supplies of all kinds must be so guarded as so prevent loss, misappropriation or damage. Old material, except rails, should be collected daily and stored in some convenient and safe place.

More or less loss is suffered, in the majority of instances, because of lack of storage facilities. In some cases no provision whatever is made. In others, proper use is not made of the facilities provided. Care is not taken to store new material, and old material, instead of being collected, lies scattered along the line. Economy and efficiency require that wherever storage facilities are lacking, the evil should be corrected as far as possible, and where they are provided, that due use should be made of them.

It is not necessary to refer to the inspection of track material here. It requires the services of experts, and in order to enforce responsibility on the part of sellers, much of the material must be watched long after it is put in the track. "The inspection of track material is important; angle bars, by reason of worn rolls, will come in such shape that they can not be fitted to the rail; rails will be defective; track bolts will fall short of



Carriage in Newfoundland.

the required length, and split bolts will have only the semblance of a split and will, consequently, be unfit for use. Track material needs a good deal of careful watching if a company expects to get what it pays for and receive what it wants."*

To simplify the ordering of material by track foremen, they should be supplied with a printed list of the articles they use so that all they need do will be to enter the quantity opposite the

* Writer on track inspection.

article. The point to be aimed at in track accounts is to reduce the clerical labor of section foremen to the minimum. This can be done by using printed forms.*

Many of the conditions that attach to the custody and use of track material apply to supplies for bridges, culverts, fences and buildings.

They are so widely scattered as to render it exceedingly difficult for the storekeeper to locate their whereabouts or ascertain the uses to which they are put. He is aided in this by returns from foremen and others.

His labors will be facilitated by opening a separate account with each lot of material located along the line. This will require that he should have almost as many accounts on his books as the storekeeper in charge of the track supplies of a division.

The returns rendered him by foremen, while not as accurate as could be wished, will afford him the information he requires, and if lacking will give him a hint of what is going on, so that he may make disposition accordingly.

Amongst other embarrassments, he will experience one common to every department of the service, namely, difficulty in securing accurate information of the disposition of material left over after the completion of work in progress. This is a most prolific source of error in railway accounting.

* I beg to invite to attention of the reader to the forms embraced in "Fiscal Affairs, Disbursements."

Material ordered for the construction or repair of structures is always in excess of the amount needed. The amount of the surplus and its disposition the storekeeper must know in order to keep his books accurately. But his necessities will not be regarded by those who carry on the work; and unless he is constant and minute in his enquiries, the information will escape him. The omission may not involve actual loss to a company, but it will involve irregularity in accounting, and invites extravagance and irresponsible practices. Moreover, if not reported, one account will be debited with more than it should, and another will be charged with less than it should, if no greater harm ensues. This is an evil in itself, as responsibility can not be enforced where cost is unknown.

The difficulty of protecting supplies used in connection with buildings, bridges and similar structures is too apparent to need reference here. The utmost protection possible to afford is more or less imperfect. However, care will be more likely to be exercised if the facts are kept before the eye of those responsible; if an accurate account is kept of each lot or article of material scattered along the line, no matter where located or how trifling its value or importance. It will serve as a constant reminder and will prevent material being overlooked or forgotten. This is about all the storekeeper can do. He should require frequent returns from foremen and others of each lot of material, giving location, condition, quantity, value, proposed use, etc.

CHAPTER XI.

INSPECTION, CARE AND USE OF OILS AND SIMILAR SUPPLIES.

The losses that railway companies have suffered from neglect to provide adequate facilities for handling material has nowhere been so marked as in connection with the use of oils. Wherever facilities are inadequate, the loss is constant and out of all proportion to the cost of correction. This fact is as apparent to the passer by as it is to experts. The losses railroad companies have suffered in this direction would afford a large dividend on their share capital.

In nothing was the inefficiency of civil engineers and managers so conspicuous in the early history of railroads as in their neglect to provide storage and other facilities for oils, paints and kindred supplies.

The practice of allowing oil to stand in barrels in the open air until used was general. About these receptacles the earth was sodden, while the air was laden with offensive odors. Annual losses were greater than the total cost of providing permanent, ample and secure accommodation would have been. The neglect arose partly from the fact that railroads did not originally contemplate the use of oils in the shape

Carriage in Siberia.

and to the extent that they subsequently employed them. Absence of provision in the first instance led to neglect to provide for it after the want was known. Conditions have, however, changed somewhat in this respect. Wherever neglect to provide facilities still exists, it is either an oversight or the matter is held in abeyance, awaiting other developments. Nevertheless, the waste is going on and is as much a loss as if the company interested were to take gold out of its vaults and throw it into the sea.

Facilities should be provided for oils that will prevent leakage or evaporation. Where justifiable, a separate fire proof building should be provided for storing. Tanks in which oil is kept should be sunken so that they may be easily and quickly filled and the risk from exposure reduced. Oils thus stored may be drawn by pump as needed; or, if intended for reshipment in large quantities, more convenient means may be provided. If the quantity used does not justify a large reservoir, small tanks conveniently located in the storehouse or in an adjoining apartment may be used.

Oil should be unloaded without delay. If facilities are lacking and it must be stored in barrels, they should be kept moist, especially those containing kerosene. Many railway companies store oils under such circumstances in their water houses where the dampness will keep the packages tight, and so prevent leakage or evaporation.

Under no circumstances should oil be left in barrels exposed to the sun. The most meagre accommodation is better than this and the small expense that a rude shed involves can not excuse neglect to provide it.

Where facilities are inadequate, the supply of oil should be reduced to the minimum; where adequate, it is probable a month's supply at least may be kept on hand to advantage.

The cost of oil is great or small, relatively, according to the intelligence and care exercised, first, in buying; second, in storing; third, in disbursing; and fourth, in using. Much careful thought has been given the last. However, notwithstanding this, the ties and roadbed of many lines are black with the oil that has been spilled from overloaded journal boxes, or because of careless handling.

The saving that may be effected by the economical use of oils for lubricating and lighting is much greater than would be supposed. It requires constant and intelligent effort. It will be found advantageous in this connection to reward those who are provident and admonish those who are not.

Those who use oils are required to be conscientious. They must possess experience and good judgment. If reckless or lacking in discretion, they will use them in excess lest mishap occur. They will use a quart when a pint would do for fear of the possibility of a journal becoming heated. The happy mean is the least

quantity that will answer the purpose without risk.

The lack of uniformity in the quantity of oil necessary to be used upon different machines (generally alike or of identical pattern) is well known to practical machinists; improper alignment, defective bearings and inferior quality of metal increase the consumption of oil. These differences lessen the value of statements ex-

Carriage in Lapland.

hibiting the comparative use of oils by machines performing the same kind of work and require to be kept constantly in mind.

The superior utility of high priced oils makes them universal favorites. The determining factor, however, all things considered, should be cost. Ease in handling or convenience and cleanliness, while important factors, should be held subordinate to this.

That kind of oil which, all things considered, is the cheapest, is the kind that should be used.

In disbursing oils for use on locomotives, the amount should not generally exceed the requirements of a round trip. Stations should be restricted to a month's supply; local depots for lubricating cars, supply trains, etc., to immediate needs, not exceeding a month's supply in any case.

The less the stock of oil carried (without transgressing the limits of safety) the more economical its use and the less the waste.

Frequent and limited disbursements also enable the storekeeper to scrutinize use much more carefully than he otherwise would. Oils are not so likely to be used to kindle fires and for other extravagant purposes under such circumstances.

The economical use of oil should be encouraged in every way. This is one of the objects of locomotive statistics. Among other valuable information, they give the consumption per mile run, and while this is dependent upon the weather, the load and the engine, still they afford generally a valuable indication of the relative economy exercised. Saving may be further encouraged by daily or monthly bulletins showing those who are careful and those who are not. Comparisons of this nature should be published promptly, otherwise they lose their interest.

In order to make such exhibits, it is necessary that account should be kept of the oil each employe receives. Upon some roads tickets are

used for this purpose; different tickets being provided for different quantities and kinds of oil. When a supply of oil is furnished, a ticket representing the quantity is left with the storekeeper; this affords the basis for his charge. The plan works very well, but a better system, perhaps, is to use printed slips upon which the different kinds of oil, tallow, waste and kindred appliances are printed in order. The quantity that the person receives is entered on this slip opposite the kind delivered him.

Foremen should be required to approve requisitions for oil. It will tend to prevent extravagance and wastefulness. They know better than the storekeeper the needs of the service, and if they perform their duty intelligently instead of perfunctorily, their supervision will prove highly beneficial. Such approval is not possible (and perhaps not necessary) with engineers, and may be dispensed with. The slips for ordering oil, referred to, are also adaptable for use at stations and elsewhere.

The best manner of supplying stations and buildings with oil is an interesting question. It is generally furnished in cans. The cans are sent backward and forward. The loss entailed through destruction of the cans and the spilling of the oil is a constant source of expense. A feasible substitute for this plan is much to be desired. One method suggested is to equip a car with oil tanks and run it over the road once a month, filling the receptacles at different buildings di-

rectly from the car by a flexible tube. The plan is practicable, and it is probable would prove economical. It would save the expense of hauling the cans backward and forward, the loss of oils spilled in transit and cost of maintenance.

The storage of oil should be carefully looked after. No combustible material should be placed near it, and danger from fire should be carefully guarded against.

The person immediately in charge of the oil supply, in common with others who handle such

material, should be subject to the direction of the storekeeper. It should be the duty of such employes to fill the lamps, lanterns, torches, etc., and attend generally to disbursements.

The proper inspection of oils can not be explained here. It requires thorough acquaintanceship with the nature of oils and the best methods of testing. In some cases primary tests are conclusive; in others they are not. Thus kerosene may be accurately tested, while valve, car and engine oils must be submitted to actual use to

determine quality. The observation and experience of the men who use the oils must be systematically sought, practical experience being, here as elsewhere, superior to theoretical demonstration or speculative knowledge. A practical storekeeper, speaking of the manufacture of oils and their inspection, says:

"Many things must be considered. Thus, the quality of lard oil must be determined by chemical analysis; it is only in this way that we can detect when it contains cotton seed oil or is made from the fat of hogs that have died of disease or from overcrowding; its burning quality depends upon its being made from the fat of healthy hogs killed for use; machine oils must be tested by actual use and analysis, the evidence of those who use them being necessary to determine their quality. Oils used by us, except car and engine oils, come in barrels. Car and engine oils come in tank cars. Car oil is not to be distinguished from engine oil except by its fluidity, the color, weight and appearance being the same. On receipt of kerosene oil, a sample is taken and tested in the following manner: We heat the oil in an open cup over a spirit lamp, the bulb of the thermometer being submerged in the oil; after a space of about forty minutes a lighted taper is passed over the oil to ascertain the flashing point, and again afterward, at a higher degree of temperature, to ascertain at what degree it will burn. If it ignites at a lower degree than it should, the shipment is returned; we consider kerosene good only when it will stand the fire test at 150 and 175 degrees. Seal oil must stand the test at 300 degrees. We draw

our car and engine oil from the tank cars into large vats under the oil house, and pump it from thence by stationary engines into tanks above, from which barrels and cans are filled for shipment to shops, storehouses, stations and elsewhere as needed. We manufacture our signal oil from lard oil and kerosene or mineral seal oil. I do not know that it is cheaper, but we are more fully assured of the quality when we make it ourselves. We have recently adopted the practice

of manufacturing our own valve or cylinder oil; whether it is more economical to manufacture than to purchase I do not yet feel certain, but we are better assured of its quality; it is manufactured from tallow oil or lard oil with an equal amount of oil called cylinder stock. The latter is the last product of the retort in refining crude petroleum. Tallow oil and lard oil are the liquid product of crude tallow and leaf lard respectively, pressed at a cold temperature;

valve oil is made by placing the two in a tank and thoroughly mixing and heating them to a certain degree of temperature by means of steam coils placed inside of the tank. In making signal oil for winter use lard oil and kerosene are used; in making it for summer use lard oil and mineral seal (at 300 degrees test) are used."

Great progress has been made in the preparation of lubricants for railroads. The process of manufacture has assumed the importance of an industry and employs extended laboratories and an army of laborers, instructors and inspectors.*

In addition to the chemical tests of oil, various mechanical devices have been invented for determining comparative excellence. While these devices measure the amount of friction and wear and tear, they are far from satisfactory, results obtained varying greatly under apparently similar circumstances. Thus in a series of experiments, ten thousand revolutions were obtained in one case while in another sixty-four thousand were obtained with the same lubricant, the friction, temperature and speed being apparently the same. "Practical differences of durability of lubricants depend not on any differences of inherent ability to resist being 'worn out' by

* The instructors are engaged in explaining the best method of using lubricants while the inspectors are occupied in seeing that the instructions are carried out, as quite as much depends on the proper use of oils as on their quality. Careful statistics are also kept of results; of the average mileage of journals and such other data as may be necessary to enable railroad companies to determine the kind of oil, all things considered, that is the most economical for them to use.

Carriage on the Upper Indus.

rubbing, but upon the rate at which they flow through and away from the bearing surfaces. The conditions which control this flow are so delicate in their influence that all attempts thus far made to measure durability of lubricants may be said to have failed to make distinctions of lubricating value having any practical significance."*

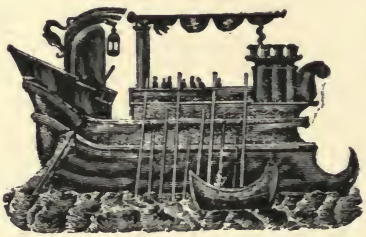
In further reference to storage houses for oil for local use, inexpensive buildings or separate rooms are sufficient, a raised shelf or platform being provided on which the barrels may be placed and tapped when tanks are not provided. If large tanks are used, provision should be made for hoisting the barrels to the top to be emptied. Tin receptacles should be used for catching the drippings from faucets. Oil storage houses for large stocks should be fireproof, one story and basement, the tanks being placed on the lower floor. The second floor should be on a level with the floor of the car. Thus a barrel may be rolled directly over the tank and readily emptied. Light oil shipped in tank cars may be withdrawn with a syphon if necessary. A pump should be provided for each tank for drawing the oil; provision should be made for the drippings to run back into the tank. The second story of the storage building may be utilized for storing oil in barrels, tallow and kindred supplies.

Subsidiary oil houses should be placed in the yards for the convenience of oilers and others.

*Professor Denton.

In cold weather oils must be heated so that they will run freely. In small houses a carefully guarded stove may be used for this purpose. Steam heat is, however, better and safer, the coils being placed according to the degree of heat required.

Every precaution should be observed to guard against fire. Oil houses should be kept clean. Open lights should not be allowed. The lighting should be done by electricity, or if that is impracticable, by carefully guarded stationary lamps.



Carriage in Phœnicia.

CHAPTER XII.

HOW FAR RAILWAY COMPANIES MAY PROFITABLY CARRY ON MANUFACTURING—SAFEGUARDS AND METHODS TO BE ADOPTED.

Railway corporations can not manufacture as cheaply as private parties. The latter are not more discerning in the selection of agents, but more exacting afterward; more energetic, more economical, more quick to reward merit, more quick to discover incompetency.

The supervision of the Owner is immediate, personal and exacting. Moreover, the spur of competition and self interest heightens the intelligence and intensifies the interest of the manufacturer. He is more careful in selecting the object of manufacture, and in keeping down cost. These facts are well known, and are the reason why railway companies buy from private parties rather than attempt to manufacture goods themselves.

There are, however, articles it is possible for them to manufacture to advantage. But the list is exceedingly small. It is only where the work is carried on as an accessory to something else that it can be done to advantage.

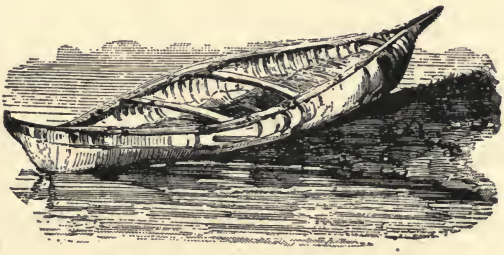
It oftentimes happens in the operation of railroads that the service of a given number of men

is required in a shop for a particular purpose, not sufficient in itself to give them work all the time. If special work is not provided, the force is not fully employed, thus preventing the company from securing the class of workmen it needs or necessitating payment for idle time. Under such circumstances the manufacture of articles may be carried on to advantage, and while the cost may be greater than a company would have to pay on the street, still it will, as a whole, represent saving. Except under such circumstances, a corporation is not justified in manufacturing articles when it can buy in the open market.

There are more or less special, non-competitive articles that railway companies can manufacture economically; articles peculiar to them; devices used on their equipment and machinery; patterns that are not kept in stock by merchants and are not competitive. These articles have grown out of changes and improvements in railway appliances. Thus, nearly every locomotive requires a particular pattern for some portion of its machinery; in other respects it may be of standard construction. Such patterns can, as a rule, be repaired or replaced more quickly and advantageously by the railway company, at the place where needed, than in any other way. The patterns multiply with the development of railroads. The attention that must be given them grows each year. They require a more or less extensive manufacturing plant upon every road.

In some cases railways rigidly restrict their work within the limits pointed out; to accessory work and the maintenance of articles that must be kept upon the ground to prevent the plant lying idle. This is the true basis of railway manufacture. The pressure, however, to extend its scope is constant. It is the outgrowth of widely different causes.

Manufacturing necessitates the employment of a greater force and greater plant than would otherwise be required. This aggrandizes local-



Carriage Among the Indians.

ities and increases the importance of those in charge. The pressure, therefore, to multiply the uses of a shop is constant and pressing. There is nothing inconsistent in this with good faith on the part of the officials and operatives of a company. They felicitate themselves in their increased sphere of usefulness and do not dream that it is at the expense of their employer. They do not know what the articles they manufacture cost; they know approximately, but not accurately. The methods of accounting in force upon

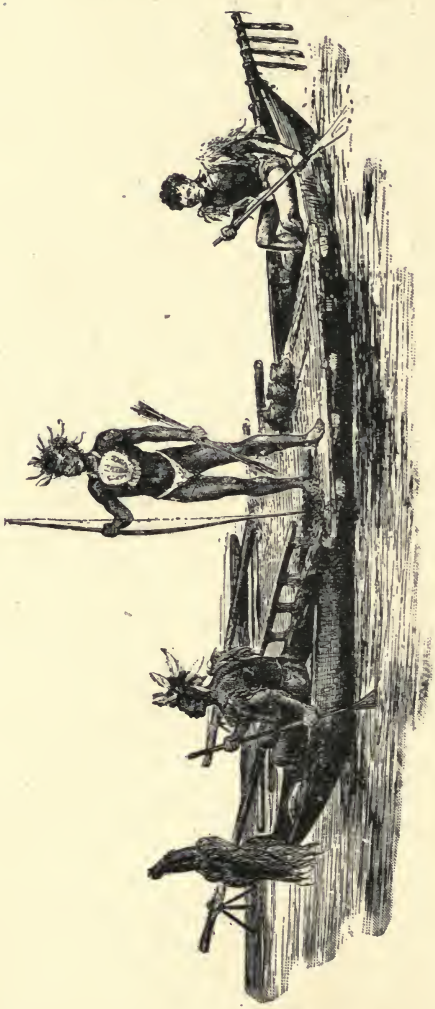
railroads do not generally permit it. To determine it, the latter must take cognizance of every ounce of material used, whether new or old, and of every minute of time expended. Also all accessory items of cost, including transportation, superintendence, wear and tear of machinery, interest and kindred items. This involves an elaborate system of accounts, not necessary or of especial importance if a company restricts its work to those articles that it must manufacture for reasons already given.

Accurate information is necessary in reference to the cost of every article manufactured. Private manufacturers possess this. No one can afford to manufacture an article without knowing whether he can do so as cheaply as others; whether he can do so at a profit or not. This is the test. Railroads rarely, if ever, possess this information. Their system of accounting is not devised for such purpose; not adapted to it. It takes no note of accessory or collateral items of cost. It takes reasonable account of the disposition of material and the time of men; its main purpose is to secure responsibility; prevent misappropriation or waste of material; prevent time being allowed employes in excess of that actually worked. It is not particular as to fractions of cost. Not only is this so, but the weakness is aggravated by the disposition of foremen and others to reduce cost by fictitious means. There are many ways of accomplishing this, but the one commonly practiced is by using old material

in the manufacture of new articles without accounting for it. No particular harm is done by this deception if it is practiced only in connection with articles that railways must manufacture whether the cost is great or small. But when practiced under other circumstances it has the effect both to deceive and rob the owner; to encourage him to carry on a system of manufacture that involves loss while apparently benefiting him. It is very difficult to prevent undercharges of this character, for they are thought to be harmless by those who practice them. Yet the habit must by totally uprooted wherever a company enters into the manufacture of goods. But this latter should not be permitted except within necessary bounds. It may, perhaps, be carried on profitably under particular men or conditions for a time, but the practice will untimately be unfortunate. The safe way is the best way, namely, to restrict manufacture to peculiar articles or work that is carried on as an accessory to something else.

The list of articles that a railway company may manufacture to advantage will depend upon the nature and extent of its property. Also, somewhat upon location. But it will be great in any event.

If locomotives, cars and the appurtenances of railroads were uniform it would not be necessary for them to manufacture a single article. Their efforts would be confined wholly to repairs. Dealers would keep the market supplied. But lack of



Carriage in New Guinea.

uniformity compels each company to provide facilities for repairing and renewing articles peculiar to it, without delay and where needed. It might keep duplicates of each article in stock to prevent machinery lying idle. But this would be impracticable. The number would be infinite and the cost prohibitory. Repair shops must, therefore, be located along the line so as to be quickly and easily accessible, where breaks may be repaired or simple articles renewed when necessary. They must be general in their use. This suggests an embarrassment.

In corporate affairs it is the disposition of every department to provide for its own wants rather than combine with other departments for common needs. This tendency on railroads, if unrestrained, evinces itself by a repair shop for locomotives, another for cars, another for track implements, and so on. One, however, is sufficient for all, except in the case of construction shops.

By restricting the number of shops and enlarging their usefulness greater economy of labor and efficiency of service are secured than is possible otherwise. An objection is that the work of particular departments is not attended to as promptly as if carried on by a subordinate department. This criticism is not tenable. The trouble does not lie in concentration, but in lack of general interest on the part of the person in charge. The remedy lies in disciplining the delinquent, not in duplicating him.

The repair shops along a road, when systematically regulated, are graduated in importance from the petty shed with a blacksmith's bellows and forge to the central shop where all repairs and renewals, so far as the convenient and economical working of the system will permit, are carried on. The small shops in their order are the avenues that lead those in charge to positions of greater importance, and teach them and stimulate their ambition. The necessity of harmony and subordination is imperative.

Each shop should be held subordinate to the one immediately above it and wholly so to the general repair shop, where all new work and general repairs should be done, so far as possible. Without constant watchfulness, the tendency, however, of each shop will be to make its usefulness general; to grow from an accessory into a system.

A great deal of thought has been given by manufacturers to means of ascertaining cost. No one appreciates so fully as they the importance of this. It is necessary among other things to enable them to put a price upon their goods. In its furtherance they have availed themselves of every device that the ingenuity or experience of men could suggest.

These devices should be carefully studied by storekeepers and accountants, and when a company attempts to do more than manufacture and repair articles peculiar to it or necessary to its convenient and economical working, measures

Carriage off Ceylon.

for accurately determining cost should be vigorously enforced.

Those in charge of accounts owe it to their employers to prevent any concealment of the cost of an article. Every opportunity should be taken to make it known to the management. It is the basis of responsibility. The duty is not discretionary, but imperative.

In the manufacture of goods, more or less material is ruined or damaged. The fact should not be concealed, but such disposition made as circumstances suggest. The practice of English roads in regard to damages arising from neglect of duty or awkwardness upon the part of operatives is much more severe than in America, as their regulations evince.*

In the manufacture of articles it will greatly facilitate accounting if each article or group of articles is given a particular number.

When a workman is credited with what is due him for labor the number upon which he has labored is charged therewith.

The use of numbers will save a great deal of writing.

* "Any workman making any article of wrong dimensions, or finishing work in an inferior or unworkmanlike manner, must make good such work, and pay any extra expense that may be incurred, he being allowed the value of old material for such work spoiled. Any workman injuring a machine, or other article, through carelessness or neglect, shall pay the amount of the damage, and be fined two shillings and six pence. Any workman knowingly making use of materials which are imperfect or otherwise unfit for the intended purpose, to pay all expenses incurred thereon, after the discovery of the defect."—*English Rule.*

The name of the article or group of articles numbered is kept in the office of the storekeeper for reference and final use.

When the work of manufacturing is completed measures should be taken to ascertain and make known the average cost. Comparison should, if possible, be made with similar articles. If the cost is excessive, or is thought to be so, the material used should be carefully scanned and the men engaged in the work interrogated, if need be. The investigation may not serve any useful purpose at the time, but will have the effect to suggest greater economy in future if there has been extravagance. The value of supervision of this nature to a company is very great. It will restrain extravagance and bring to the notice of the management those who are efficient or otherwise.

Private manufacturers discover efficiency intuitively. Great corporations discover it more generally through the mechanical processes that exhibit results; through the accounts. These processes consequently are of especial value to them and should be regulated accordingly. If neglected, experience, capacity and faithful service will oftentimes remain unknown and unrecognized.

Carriage in Ancient Venice.

CHAPTER XIII.

INSPECTION, CARE AND USE OF BRASSES, BABBIT METAL, AND SIMILAR MATERIAL—FISCAL METHODS.

The great value of brass and the general market that exists for it add to the difficulty of protecting it. In shipping from one point to another it is necessary to lock and seal the cars or otherwise surround the material with especial safeguards. Brass in store must be guarded as carefully as silver. The danger of loss is constant and imminent, not so much from employes as from others.

Methods at once varied and ingenious have been adopted to prevent the loss or careless handling of brass and similar material; aside from the rule requiring it to be carefully guarded, the rule that those who make requisitions for such material shall return the worn out or broken articles, has been the most effective. It is very simple. But it makes every one particular. Thus, when an accident occurs, the person in charge collects every article that has to be replaced. Without it he is sure to experience more or less trouble in replenishing his stock. Its possession facilitates the exchange; renders his task easy.

This system of exchanges is a constant reminder to engineers, car repairers and others

that in order to replenish their stock they must preserve worn out and broken articles; must not allow them to be lost or carried off. Such exchanges are constantly going on.

An account should be opened with each person to whom a brass is given, charging him with the number. When the article is returned worn out or broken, a new one is given in exchange. The original charge need not be disturbed. When, however, a person leaves the service, the account should be closed.

In the event the supply in the possession of an employe is lost or diminished, the books should be changed accordingly. The English companies are very strict; if satisfactory account can not be given of a missing article, its custodian is held responsible, the value being deducted from his wages. This is generally fair and can not prove a hardship, while its enforcement will prevent many irregularities and losses.

Brasses in the hands of workmen should be inventoried monthly, or oftener, when those having them in charge leave the service.

It is impossible to prevent occasional loss of a brass, but the circumstances attending it are susceptible of explanation. The interests of the service require that this explanation should be promptly forthcoming in every instance.

In addition to orders for brasses and kindred articles to replace those worn out or broken, there will be a demand for such supplies to form new stock; original orders, in fact. In such cases

there is, of course, no old material to give up. The storekeeper should satisfy himself that the order is necessary and equitable. If the issue is for construction purposes, or immediate use, the charge should be made accordingly. If it is to be held in reserve, it should be charged to the person holding it.

The number of different forms of brass castings that a railway company uses is much larger than would be commonly supposed. The care of patterns and the protection of the material before and after manufacture require ample provision. Wherever possible, a separate room should be provided. When the supply does not justify this, a secure cupboard or other enclosure should be used.

It should be remembered, in this connection, that it is oftentimes more important to protect the raw material or scrap than the manufactured article. This is so when the latter has a mark or stamp upon it by which it may be identified. However, guardianship must in all cases be incessant and intelligent.

In distributing brasses, the rule observed in the case of other material, that the supply shall not exceed actual needs, should be rigidly enforced.

Not only must articles in store and in use be carefully looked after, but all equipment passing to and from other roads must be inspected at the time of transfer and articles worn out, damaged or missing properly noted and return made

Carriage on the Upper Elbe.

thereof. The importance of this examination has suggested to the car department of railways the necessity of co-operating in the work and of having it carried on systematically by skilled inspectors.

In reference to forms of accounting, they should be such as to render the work easy, simple and thorough. The blank for ordering articles should have printed thereon the different kinds used. It should contain a column for entering the number on hand; also the number returned. If an article has been lost, there should be a place for explaining the loss. If an employe is responsible for the loss, the English companies, as already pointed out, require that he should pay the value of the article. Orders for brasses should specify the purpose for which they are to be used, and in the event they are not thus used, immediate notice of the fact should be given the proper official.

The loss of brasses, babbit metal and similar articles suggests others entirely different. Take the item of stationery, for instance. Everywhere employes use the stationery of their employers as their own. The universality of the practice excuses and justifies it. It has its counterbalancing considerations. The practice is more common with the employes of private individuals than with those of corporations. The use of the paper, envelopes and stationery of the employer is recognized as a perquisite of the employe. Abstractedly considered, the practice is

indefensible. As a matter of fact, the employer does not suffer at all, or only in a minute sense. The use of his stationery advertises him, while it assists those under him to eke out a slender income. So long as it is thus restricted no harm is done. In all other things, however, the property of employers should be scrupulously respected. When it is not, the act is indefensible; this is especially the case if the appropriation is for purposes of gain.

The benefits that employes derive from the concessions and courtesies of employers are much more general and valuable than is commonly supposed. They are none the less valuable because the employer does not always suffer from them. Thus the passes given employes are of enormous value to them, while the loss to the company is very small, if it suffers any loss at all.

In the majority of cases those who use the passes would not travel without them and in other cases the employer recoups himself by the increased loyalty of his servants and in their ability to work for less wages. I might greatly extend the list of mutual benefits. It is, however, unnecessary. I refer to the subject simply to illustrate the beneficent relations that exist between employer and employe and the general disposition of the former to aid the latter.

CHAPTER XIV.

COLLECTION, CARE AND UTILITY OF OLD MATERIAL

There are two classes of old material: that which has no value except to the junk dealer, commonly called scrap, and that which may, with slight repairs, be used again.

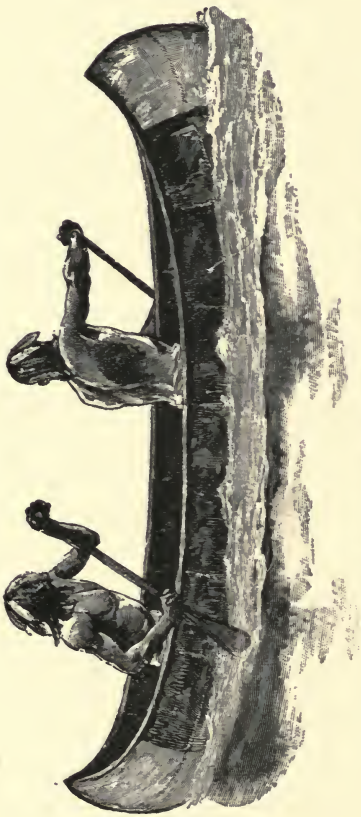
In the hurry of business more or less material that might be used again finds its way to the scrap heap.

All old material should be carefully assorted and classified before being sold. This process requires preparation and must be carried on by skilled persons.

Old material should be examined, first at the place where it is collected and afterward at the general depot. This double inspection will prevent material being sold that may be used again.*

It is probable there is as little waste on a railroad as elsewhere. But there will always be such instances. It does not matter whether it arises from ignorance, thoughtlessness or indifference; the monetary loss is the same. Instances, while not common, are frequent. Thus, switch chains, frogs, bolts, injectors, cylinders,

* "Any person putting material upon the scrap heap which is otherwise valuable, or carelessly wasting material in any other way, will be punished as the case may deserve."—*Extract from Rules of English Road.*



Carriage Among the Indians of North America.

cocks and similar implements that might be used again, are thrown aside as worthless. In order to prevent the losses their sale would involve, it is necessary that old material should be inspected by men capable of determining that which is usable from that which is not; and who, moreover, will call the attention of officials to persistent cases of neglect.

After usable material has been separated from the other, the latter must be assorted according to its value. This is very important. Iron, steel and brass, for instance, must be kept separate and classified according to value. To mix the different kinds and classes is to lessen their value.

The promptness and thoroughness with which old material is collected, assorted and stored is an evidence of efficiency.

Neglect breeds demoralization, besides the direct losses it engenders. It is frequently excusable, because of other and more urgent duties. It is a question of values. For a busy man to leave his work and go out of his way to collect old material of less value that is in no immediate danger of loss or misappropriation, is not economy. But if risk may be avoided by placing convenient receptacles for old material about the various buildings and along the track of a railroad, where it may be deposited by men otherwise occupied, then, undoubtedly, neglect to do so is inexcusable. The work of removing the material from such receptacles is not important.

It may be carried on at such time and in such manner as may be most convenient. Wherever provision of this nature is neglected, the loss of old material will be constant. It will be covered up with cinders, dirt, weeds, brush and grass; will be hidden away behind buildings and under platforms and stairways, or stolen by the thieves that lurk about every railroad yard.

The old material that accumulates about particular stations, offices or buildings is oftentimes so small as hardly to merit attention. It possesses, however, in the aggregate, an enormous value and its care merits the same attention as other matters.

The bulk of the old material accumulates about the shops and along the track. The difficulty of looking after the former is not great, as it is restricted to narrow limits, and is under the immediate eye of the storekeeper.

The care of old track material is difficult and liability of loss great. This particular phase of the subject is referred to elsewhere.

The following instructions in regard to old track material, from an experienced and watchful superintendent, are pertinent:

"Each section foreman should have a platform for storing scrap picked up along the road during the day. Every tidy and painstaking foreman will carefully pick up every piece of scrap and put it on the pile at his tool house. Any article too large to be placed on his car he will remove on his dump car, or

else have a way freight train stop long enough to permit him to load it. In this way the scattered scrap, representing thousands of dollars annually, will be taken care of and saved from loss. About the middle of the month each roadmaster should start a car on some way freight train for the purpose of gathering up scrap at section foremen's houses and at depots, and ship it to some central point where it may be assorted and such articles as are fit for further use separated from the others; the latter being sent away, while the former is redistributed for use."*

Carriage in Bassora.

In the breaking up of buildings and other structures, the material that is susceptible of further use should be assorted and put aside. The process is not more difficult than in the case of common scrap. But in order to secure accurate accounting, the material thus collected must be brought onto the books so as to be charged when subsequently used.

* "Each foreman should be responsible for collecting any coupling chains, hooks, pins, iron, or other material which may be found on the line, and for having them conveyed to the nearest station weekly."—*Extract from Rules of English Road.*

Another class of old material should be noticed, namely, the papers and books that accumulate about the stations and offices of a company. They are of sufficient value to make them worthy of attention.

The separation of the papers and books that it is desirable to retain from those which may be sold requires to be conducted with the greatest care. The work must be performed by those experienced in such matters, and able to distinguish at a glance that which may be safely disposed of from that which must be kept. The assortment of papers must, in the majority of cases, be made at the place where the papers have accumulated. No rule can be laid down except, perhaps, in reference to traffic papers and books at stations.

The great bulk of papers at the headquarters of a company must be kept, practically, forever. They may not, indeed, be necessary to protect the company, but no one can tell when they may be necessary to protect the good name of some officer or employer.

In regard to accumulations at stations and local offices, it is a good rule to require that no book or paper shall be disposed of except under the direction of the authorized officers and inspectors of a company.

Traffic papers must be retained until the expiration of the period of limitation fixed by statute. This period varies in different states, and in order to cover interstate business the

records must be retained for the longest period of time which the statute of limitation covers in any particular state. When no claim against the carrier for loss, damage, overcharge, or other purpose, as represented on such papers and records, can be prosecuted, they may be sold.

It should be the duty of inspectors and traveling auditors when visiting places where old records and papers accumulate, to personally superintend the way billing and shipment of the same to the sales agent or general storeroom. The waste paper that accumulates about offices should be preserved and shipped with the records as stated above; or if it is inconvenient to retain it until such time, it may be shipped separately*

Old material should not be sold, except under the direction of an authorized officer. The necessity of limiting this power is manifest. Such sales are commercial transactions and require commercial skill and knowledge. They should be governed by the markets of the country and with due reference to transporting from one point to another, including cost of handling. In this way material will be disposed of in the place where it accumulates if it can be sold there to advantage, thus saving the company the risk and cost of transportation and rehandling. The seller must possess a general knowledge of markets in

* I think it would be a good plan for every company to have a central storehouse, conveniently arranged, for keeping their old books, records and papers until such time as they may be sold.

Carriage in Greenland.

order to get the highest price. Only those who make a specialty of such knowledge possess it.

In order that due notice may be had of old material, monthly returns should be made of the quantity on hand, kind, amount disposed of, how disposed of, and such other particulars as the official in charge may require.

When shipped, old material should be way billed by the station agent as in other cases.

If possible, old material should be accurately weighed before shipment as a check upon the receiver. It should, however, be reweighed by the latter and the invoice corrected according to his weight.

In transferring old material from one storehouse to another, the practice enforced in other cases should be observed, namely, the person shipping should receive credit while the person receiving should be charged.

When old material is shipped directly to a rolling mill, or elsewhere off the line, without weighing, the agent of the company on the ground or at some intermediate point should weigh the same and certify the weight to the storekeeper making the shipment; also to the proper officer of the company. At the close of each month, moreover, such agent should make a report to the officials named of all cars thus weighed, specifying the date, number, kind of scrap, consignee, weight, and such other particulars as are necessary to enable the company to keep accurate and full account of the same.

Disposition must be made on the books of old material that accumulates. There are various ways of doing this. Probably the best is to credit its value to the things to which it was originally charged; on the other side of the account, material on hand will be debited. If the material comes from an old building that is being renewed, it should be credited to repairs of buildings; if from a building that is being destroyed, without being replaced, construction should be credited. Similarly old material taken from the track, bridges, culverts, fences, equipment, etc., should be credited to the account affected.*

Much of the old material that accumulates can not be identified. This will be so in regard to the filings, drillings and borings that accumulate about a shop. It has been suggested that a good way to dispose of such amounts is to place them to the credit of a general account, and apportion them afterward to the different maintenance accounts (with which the shop keeps account) on the basis that the amount expended on such accounts bears to the total amount of material expended. Thus (if it is a locomotive shop), the credits would be apportioned to the various locomotives according to the total amount charged to them during the month. The same rule should be followed in regard to cars and machinery. If

* One way of arriving at these ends in accounting is to deduct the value of old material from the amount charged for renewing the thing; thus, the amount of the old material taken from a locomotive would be deducted from the cost of repairs or renewals to such locomotive.

it is a shop where all kinds of work is done, the apportionment must be general, to the extent that work is general. Whenever the amount of accumulated old material justifies it, a division

Carriage on the Yang-tse-Kiang River.

may be made on the basis of particular classes of material; thus, credits for old cast iron would be based on the amount of charges for cast iron; credits for old car wheels on the new wheels used; old wrought iron on the wrought iron charged,

and so on. By devices of this kind each storekeeper will, according to his intelligence and interest, be able to arrive at an accurate disposition of the credits that arise from old material.

In order to better facilitate crediting old material to the proper account, it should be turned over to the storekeeper as fast as it accumulates. The matter will thus be disposed of while the facts are still known. It will also prevent loss or improper use of the material.

The value of old material and the indifference regarding it require:

First, that it should be collected daily, except in the case of rails.

Second, that it should be assorted forthwith, with a view to determining that which is usable from that which is not.

Third, that it should be classified according to value.

Fourth, that it should be protected.

Fifth, that it should be forwarded by local custodians to a central depot when a carload has accumulated, or oftener as may be desirable.

Sixth, that it should be reassorted, reclassified and reweighed at the central depot, and due measures taken to protect it until such time as it may be disposed of.

Seventh, that it should be sold by persons familiar with the markets for such material.

CHAPTER XV.

ACQUISITION, CUSTODY, PRESERVATION AND USE OF TOOLS.

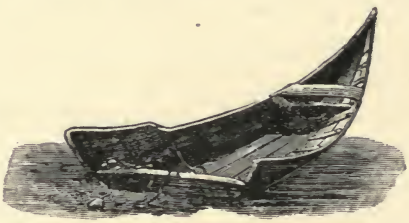
Railways require to exercise care in guarding their tools and hardware. Every company loses more or less of such articles. They are coveted by some because of the price they will bring; by others for their use simply. The latter is the more frequent occasion of loss. Indeed, the number who purloin to sell is so small as to hardly merit attention.

Tools of common use, such as saws, hammers, files, hatchets, also lamps, are so convenient about a house that they offer constant temptation to the unthinking. To buy would be a hardship, perhaps an impossibility. Moreover, acquisition without purchase enhances the satisfaction of ownership; makes the thing doubly valuable. Such is the perversity of human nature. Many articles of hardware are also taken. And for like reasons.

There is something very attractive about new tools and hardware to a mechanical man. They possess a glossy, cheerful look, that suggests many uses. The sight of them creates a desire to own. They are to him what a piano, or clock, or vase is to a town lady; an assortment of choice

household utensils to her rural sister. But what is singular is that the taker does not associate the idea of stealing or wrong doing with the act of taking. The personality of the owner is so vague that he is entirely forgotten; his rights not considered.

Indeed, the distinction between owner and employe is often lost sight of by those who work for corporations. Not that the latter are dishonest; they are not. But the spades, axes and shovels that lie scattered here and there seem to have no



Carriage on Lake Thun, Switzerland.

owner; seem to be quite as much the property of one man as another, except that they have much less relative value to the owner than to those who work for him.

What more natural, then, than that the shining implements that the thrifty householder needs should sometimes be borrowed by him and that their return should sometimes be overlooked and finally forgotten? Such practices are not general. On the contrary, they are exceptional, and those who indulge in them (small as the number is) would be horror stricken if told they were

committing a crime. The act is not criminal except when committed by criminals. It is the result of thoughtlessness growing out of the neglect of the owner to properly guard his property. It is, however, none the less to be discouraged. The losses it engenders, while they do not seem to affect anybody, really affect the fortunes of individual people, as real and *bona fide* as the employe himself.

The indefensible acts of the few necessitate rules and regulations governing the many. Such is the origin of the law. It holds in check the upright and strong as well as the vicious and thoughtless. The same is true of the rules and regulations of railroads, more particularly those looking to the protection of property.

Strict rules are necessary to prevent the loss of tools or their abandonment while still serviceable.

Many tools that might still be used with a little repair will be cast away if care is not exercised. Improvidence will also characterize their use. I have heard it stated (whether truthfully or not I do not know) that the wear and tear of a company's tools in the hands of mechanics amounted to fifty per cent. per annum, while in those cases where the tools were owned by the operatives themselves it was not over twenty-five per cent.*

* On the other hand, as a set-off against this apparent loss, it is stated that where employes use their own tools the result is not satisfactory. To use the words of my informant: "There is a question as to the advisability of employes using their own tools; they will work with them just as long as possible, and the consequence is that they will not do good work, and will take too much time for that which they do."

The propensity to appropriate or ill use property belonging to others must always be guarded against. A means of guarding the supplies of corporations in the hands of employes is to restrict disbursements to actual needs.

The disposition of employes to order more than is needed and to fail to properly guard the surplus is natural and unavoidable.

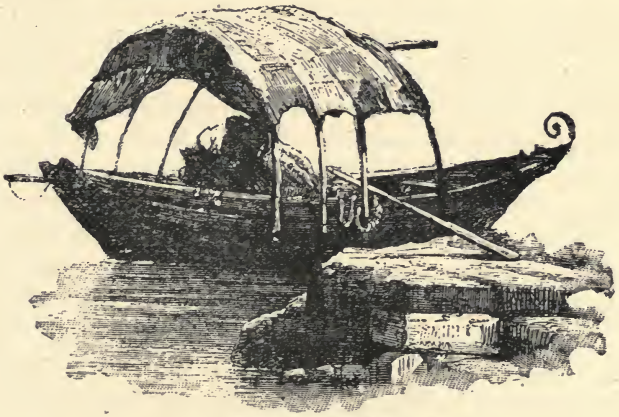
It is difficult to build up economical habits in employes.

It is easy to build up extravagant habits in employes; the latter are aggravated by loose methods of government.

Frequent changes of managers are demoralizing. They breed uncertainty. One official will enforce the most careful economy in the use of tools; another will not give the matter any consideration at all.

Rules and regulations should be uniform and consistent; such as not to harm anyone honestly desirous of fulfilling his obligations, but sufficiently strict to reach the thoughtless, the improvident and vicious, taking hold of the latter, indeed, with iron hand. The English railroads are very strict in this respect and much more methodical in their measures of government than we are. Some of their regulations will be found embodied further on in this chapter. Many of them sound very queerly to us; they have a smack of frankness and good sense about them that is refreshing to Americans, who durst not for their lives call a thing by its old fashioned Saxon name, if

it refers in any way to the populace, more especially the voters, who in our lofty sentimentalism we agree in designating by the euphonious title of "wage workers."* If the wage worker, however, be a man who has accumulated a little money, a few shares of stock, by his industry and saving habits, the case is different. In such event it is fashionable to call him a thief, monopolist,



Carriage on the Lago Maggiore.

gold bug, speculator, a grinder of the faces of the poor, and so on. If we want a vote, this will help to get it, and none of us know when we may want a vote. We all of us have a weather eye for the offices, and a soft side for the voter! We are

* When I worked upon a farm, I labored; was called a *Laborer*, was a *Laborer*. Since then, however, the word has apparently become offensive, as we no longer hear it. Under similar circumstances I should doubtless now be called an "Industrial Agent," "Soil Cultivator," or "Wageworker."

very tender of him in the aggregate; very neglectful of him individually.

In giving out tools, an account should be opened with each employe, charging him with those he receives and crediting him with those he returns or accounts for.

No tool should be given out, except in exchange for an old one; save when an original stock is created. Those who have tools should be required to return them before getting new ones. This rule is so simple that anyone may understand it, and so comprehensive that its observance will protect a company from carelessness and theft. Of course there will be exceptions to the rule. Articles will be lost or stolen without anybody being to blame. In such cases it would manifestly be unjust to compel the employe to make them good. Exceptions must, therefore, be made. But the utmost thoroughness and frankness should be observed in scrutinizing losses and in looking after property in the hands of employes. This will not injure anyone and will benefit all.

No specific rule can be laid down for guarding articles in the hands of employes. It must be such as circumstances require. Thus, rules that are practicable for implements used by mechanics about a shop would not answer for those used by train, station and road men.

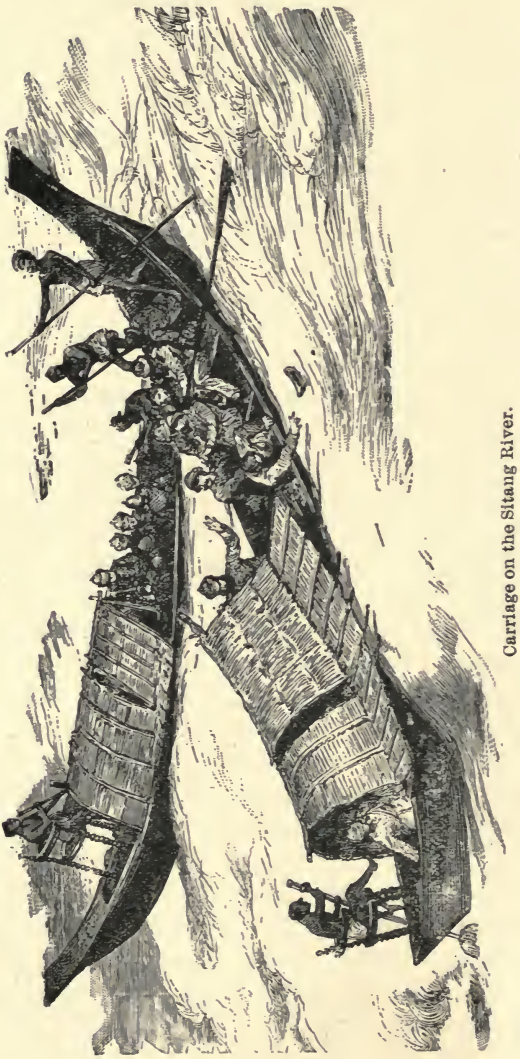
Where a storehouse is in immediate proximity to a shop, it should be made the receptacle for storing tools at night or when not in use. In

other cases, different provision must be made, but it should be of the same general nature.

The more simple and economical the method of keeping a record of the tools in the hands of employes, if it accomplishes the purpose, the better. It has no value except for the moment. It does not invite elaborate bookkeeping.

At shops, a room should be set apart for storing tools, a compartment or pigeon hole therein being assigned to each workman. When the tools are given to the men, a receipt should be taken therefor; on the return of the tools a night, the receipt should be given up; when the tools are taken in the morning, the receipt should be delivered to the storekeeper and placed in his compartment in lieu of the articles. In the event a tool is not returned at night, the reason should be ascertained. This method is simple and thorough.

When tools are delivered for use away from the storehouse, a receipt should be taken and a special charge made against the employe. A duplicate of the receipt should be kept by him, so that he may always have a record of the article charged against him. A very good way to treat such accounts is that observed by banks with their bills receivable account. Thus, when a charge is made, the credit line opposite is left blank until required to offset the debit. The blank lines on the credit side always show the number of bills unpaid. With charges for tools, the number of blank lines opposite the charges



Carriage on the Sitang River.

would represent tools outstanding in the hands of workmen, and a casual glance would inform the storekeeper of the status of each account.*

The tools and devices of a company should, so far as practicable, be stamped with its name. Articles in the hands of employes should bear their private mark.

In order that due responsibility may be enforced on the different lines of a road, a record of the tools used must under certain circumstances be kept by a particular storekeeper; all other storekeepers must report to him. If a trainman can procure tools at different storehouses, the charges therefor should be summed up by the general storekeeper and the recipient held responsible for the aggregate number he receives. To enable this to be done, each storekeeper must report to the central storekeeper daily the articles he delivers. If an old article is returned in exchange, the fact must also be reported so that credit may be given. This concentration of accounts is unnecessary except in the case of employes who procure tools at two or more storehouses. When they are supplied by a particular storekeeper, such storekeeper can exercise the supervision that the central storekeeper exercises in the other case.

Not only should old tools be returned before new ones are issued, but the rule should apply to

* The form of return described in connection with the distribution and use of station and train supplies is, perhaps, superior to this method.

other articles, such as paint brushes, brooms, lanterns, feather dusters, pails, switch chains, jackscrews, wheelbarrows, crowbars, etc. It should apply to every article which, when no longer needed, may be returned as evidence that it has not been misappropriated or lost through neglect or otherwise. The list comprises an enormous number of articles of small value; superficially, a record of them will appear unnecessary and extravagant. But this looks only to the act and not to the effect; considers only the value of particular articles (which is not great), rather than the aggregate value, which is enormous.

Orders for tools (except when old tools are exchanged for new ones) should be approved by an official conversant with the needs of the person making the order. This duty requires experience, firmness and tact.

If tools can not be delivered to the storekeeper at night, as described, secure boxes should be furnished in which to keep them. The rule should be to place it within the power of every employe to protect the property entrusted to him, so that if loss occurs, the presumption will be that it is because of neglect.

An inventory should be taken of all tools in the hands of employes at frequent intervals.

When an employe leaves the service, or has no further use for tools, they should be delivered up or accounted for before paying him his wages.

An inventory of articles in the hands of employes will serve to discover any not needed. If

articles are found not charged, it will indicate lack of efficiency in disbursing or accounting. The inventory will also call attention to the condition of property in the hands of employes; the care they exercise, etc. It will emphasize the necessity of guardianship.

In regard to tools used by trainmen, the following extract from the letter of a practical storekeeper is interesting and valuable:

Carriage in the East Indies.

"Tools used on locomotives should be issued by storekeepers on orders from foremen.* As far as practicable, enginemen should get their supplies and tools from one place. For example, an engineer running between Boston and Albany should procure what he needs from the Boston shop, getting at the Albany shop only such tools as are indispensable for his trip to Boston. The master mechanic can regulate the furnishing of tools to enginemen by instructing them where to procure what they need and by giving the foremen at different shops instructions as to what

* Unless they are in exchange for old tools. M. M. K.

runs they shall supply. In this manner the different foremen can keep posted and will know if an engineman is careful in the handling of his tools or not.* Engineers, as a rule, are careful. They like to feel sure when they start out that they are not going to run short of anything, and as they do not like the trouble of going over their stock at the commencement of each trip, they keep their tools under lock and key. Orders for tools for use on trains should be made on the storekeeper by the conductor, but should not be filled by the storekeeper until approved by the superintendent or some authorized person.† Trainmen are inclined to be careless with tools, if all that is necessary to obtain new ones is to make an order on the storekeeper. But if the order must bear the scrutiny of the superintendent, they will be more careful.

"The storekeeper should be empowered to refuse to fill an order if he sees anything out of the way. For instance, if he should know that a conductor had recently had a number of tools similar to those called for by an order, he would be justified in referring the requisition back to the superintendent for further consideration. As a rule, an order that a storekeeper would not fill would never be taken back to the superintendent. Tools on trains, unless carefully looked after and guarded by the crew, are very liable to be stolen. The most effective way to make a crew take care of their tools is to hold them responsible."

* If the rule required that all tools disbursed should be reported to a central shop, this requirement would be much more easily enforced than in the manner stated here. M. M. K.

† Except in the case of the exchange of new tools for old. M. M. K.

The distribution and care of tools is more or less complicated under the most favorable circumstances. No two persons will agree, it is probable, as to the best method. The plan I have outlined, however, is both efficient and economical. An experienced railroad man, referring to the subject, says: "A new system ought to be instituted for the delivery of tools and supplies. I would supply each engine, way car, coach, section foreman, in fact, every person and everything, with a complete outfit. Every article to be stamped with the name, as 'Coach 95,' 'Engine 236,' 'Section 5,' and so on. I would make the person immediately in charge responsible, and when a new article was wanted, would let him understand that the old one must be returned or a satisfactory explanation given. Every day, lanterns, wrenches and hammers are lost or stolen, or some mishap of a like nature befalls, which would not happen to one's own property. To start such a system would cause trouble and annoyance, but when once established would more than pay for itself in the saving effected. Many of the houses in this frontier town have lanterns that belong to the railroad company, which have no right there, and no doubt numerous other articles which can not be identified have found their way to private houses in the same manner."

The enforcement of the rule requiring the return of the old article before issuing a new one will prevent the depredations he refers to. He

Carriage off Manilla.

exaggerates the difficulty of adopting the system. All it requires is that an inventory shall be taken of the articles in the hands of employes, and that the same shall be specifically charged to them.

The system should not be restricted to tools, but should be applied to articles of every kind, lanterns, brooms, axes, etc.

When tools are shipped away, a receipt should be returned by the receiver, so that the sender may be sure that the property has reached its destination.

In sending tools back and forth for repairs, no formality is necessary, except such as may be needed to ensure their reaching their destination quickly. Many devices are employed for this purpose. Sometimes the property is way billed; in other cases it is checked like baggage; again a tag is attached. It depends on the nature of the material. A good plan for a single article shipped by baggage car is to attach a metal check with the address of both sender and receiver; thus, the token may be used in both directions and for many times.

More or less care is required to be exercised to prevent loss of tools in passing back and forth. My attention has been called to a device for track tools that is highly recommended for its simplicity and effectiveness: "Each section foreman is provided with a strong iron ring, made so that it can be bolted together; to this ring is attached a copper tag stamped with the number of section

and name of station. The section foreman strings his tools on this ring when he desires them to be repaired and sends them to the shop. A small attachment enables him to send his wrenches on the ring. For crowbars a strong brass band, stamped in the same manner, is provided. This is a much better way than sending the tools tied together with string." The same person suggests a rack fixed upon springs in which to ship lamps and lamp globes back and forth on the line without the labor of packing or risk of breaking. The devices for shipping implements and tools would fill a chapter.

The methods enforced by the English companies for insuring faithfulness and care in the use of tools are very sweeping. I can not do better than embody the most pertinent here. They are worthy of careful study. They are as follows:

"Every mechanic must be provided with such tools as are usual in his trade, and his chest will be examined by the foreman when the workman leaves the service. Every man will be required to see that each of his shop tools bears the initials of the company and his own private mark. Every man borrowing tools from another must be careful to return them immediately they are done with. A list of each man's tools will be kept. When any workman requires a new tool, he must apply to his foreman for it, who, if it be necessary, will either supply it or give instructions for it to be made. All new tools must be given to the men requiring them by their foreman, who will receive those they are intended

to replace, and no tools must be made or obtained without such authority. Any man using taps, dies, rimers, gauges or templates must see that, when done with, they are immediately returned in the same condition as when received to the person appointed to take charge of them. His not calling the attention of that person to any defects or damage at the time he receives them, will be considered a sufficient proof that they were then in good order; and if any of them should be lost, the man to whom they were delivered will be held responsible. Private tools are not allowed to be made in the shops under penalty of instant dismissal. Any man on

Carriage in China.

leaving the service of the company will not be paid his wages until he has delivered up to his foreman the key of his drawer or tool chest, and the quantity of tools charged against him, to the satisfaction of the person authorized to receive the same.

"A lock and key will be supplied to each man's tool box and drawer, in the first instance, which must be kept in a proper state of repair afterward by the person to whom it is given up. Any person losing the key of such lock must replace it at his own expense; and any man breaking open another man's drawer, box or lock of any kind will subject himself to dismissal. No

workman will be allowed to take out of the works any tools or materials, unless they are specified by his foreman upon the pass, and the number of pieces stated. All passes must be left with the gatekeeper, who is required to take an account of all material of any kind which passes from the works through his gate. All tools and implements required for the repair of the line must, when not in use, be kept locked up in a building, or in boxes, for the security of which each foreman or ganger on his own length of line is responsible. When a man leaves the service he must immediately deliver up his uniform and all other articles belonging to the company. Any money that may be due for wages to any man leaving the service will not be paid until the clothing, book of rules, lamps, flags, tools, detonators, and all other articles the property of the company which may have been supplied to him, shall have been delivered up. If not delivered up, or if any article be missing or damaged by improper use, the cost of such article or the repair of such damage shall be a debt due from the man to the company, and may be deducted from any pay then due, and if such pay be found insufficient to meet the claim, will become a debt recoverable at law. As regards the engineering department, the tools used by platelayers are in charge of the various way inspectors, and must be replaced, when required, in accordance with instructions. Stock must be taken at the end of each half year, when each ganger must give an account of the tools in use on his length, which report must be certified to by the permanent way inspector and sent to the storekeeper. With respect to tools supplied to workmen em-

ployed in the permanent way shops, each workman is provided with a drawer or cupboard, with lock and key; the drawer and key must be numbered, and all the tools used by the man to whom the drawer or cupboard is appropriated must be marked with the same number and stamped with the name of the company. The man will be held responsible for all such tools, and in case of loss, the amount will be deducted from his wages. With regard to the locomotive department, each man engaged in the working of engines, etc., receives a proper equipment of tools, and is held responsible for the care and custody of the same. When an engine is sent into the shops for repairs, the driver must hand in the tools, etc., and if they are found to be complete and in good order, a receipt will be given by which he can claim the tools when the engine is again ready for work. If any irregularity is discovered, the case will be dealt with by fine or otherwise. The regulations in force in connection with the tools supplied to workmen employed in the locomotive shops are similar to those which apply in the shops belonging to the engineering department. Permanent way materials are supplied through the chief storekeeper. As soon as they are delivered on the ground, they are in charge of the permanent way inspector of the length where delivered. Each inspector is charged from the divisional office with the material supplied to him. He is also credited with all that is used, a daily record of which must be kept by the gangers under him, and sent to the divisional office fortnightly. Stock of all material must be taken every six months, and by comparing the stock on hand with the amount

Carriage in Cashmere.

charged, the slightest difference will be detected, if any, in each inspector's stock. In the case of small stores, they must be kept in the small stores depots, of which there are three on each division, and requisitions for daily consumption, as required, must be sent by the inspector to the storekeeper. Stock must be taken of these small stores every six months, and the amount on hand checked with the book balances. With respect to tools supplied to workmen, they must be supplied by the storekeeper upon an order from the inspector. Stock must be taken of all tools every six months, so that it may be ascertained if any are not accounted for. Workmen must make good any tools entrusted to them which they may lose."

Some of the more important rules and regulations governing the custody of tools and other articles may be briefly recapitulated as follows:

Tools shall be issued from the supply depot only on requisitions.

When not in use, they shall be returned to the storekeeper for safe custody.

When an article is delivered to replace an old one, the latter must be returned. In the event it is not forthcoming, the reason therefor must be investigated, and, if it shall appear that the loss is due to the negligence of the holder, he shall pay for the same.

So far as practicable, a particular storehouse on each line shall be designated as a supply depot for tools. Tools distributed from subsidiary shops shall be reported to the central storehouse.

An account shall be opened at the central storehouse with each employe, charging him with the articles he receives and crediting him with those he returns.

When tools are delivered to isolated gangs of men, some person, to be designated, shall have charge. He shall see that they are collected, counted and locked up each night and that every tool is accounted for or the fact reported to the storekeeper.

A receipt shall be taken for all tools delivered. A duplicate thereof shall be given to the person receiving the tools so as to prevent misunderstanding.

At shops a room shall be provided with receptacles for the tools of each workman. At night the tools shall be placed therein. In the morning, when taken away, the receipt of the workman shall be placed in the receptacle in lieu of the tools.

The rule requiring that old and broken tools shall be returned before new ones are issued shall be applied to implements and utensils of all kinds, such as paint brushes, paint pots, ladders, pails, brooms, pulleys, tackle, chains, lanterns, axes, wheelbarrows and other appurtenances, the return of which will be an evidence that the article which it is desired to replace has not been lost or misappropriated.

CHAPTER XVI.

KINDS OF FUEL: THEIR UTILITY, ACQUISITION, CARE AND USE.

[NOTE.—In railway phraseology material is designated separately from fuel. However, when I speak of material or supplies I also include fuel.]

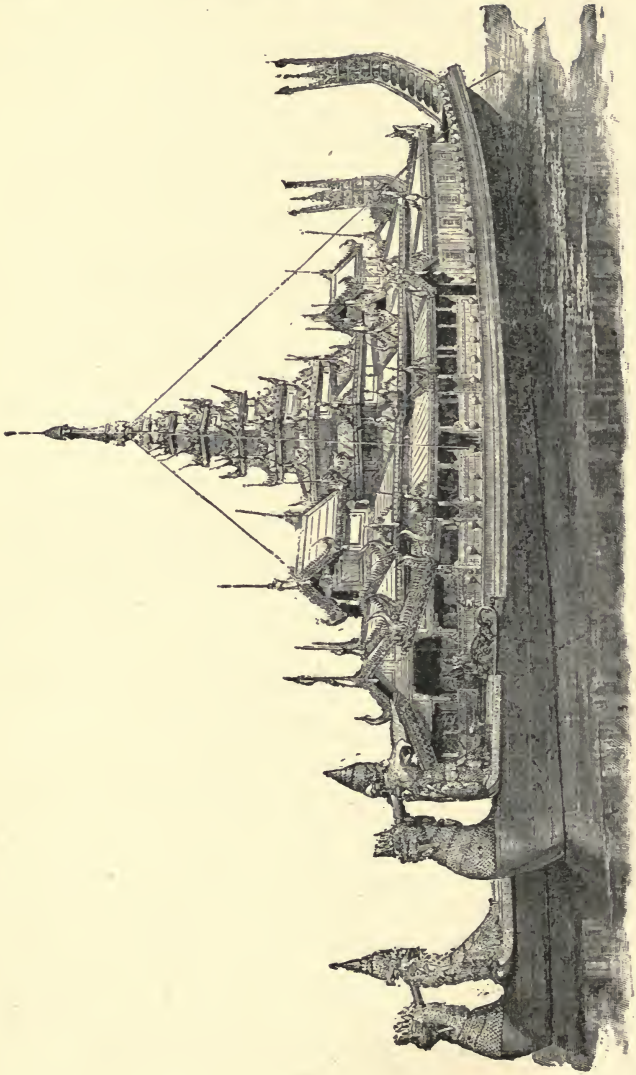
The deterioration of wood commences as soon as it is seasoned after being cut. Each day thereafter detracts something from its heat producing qualities. The process of decay is not the same with all woods. Moreover, it is great or small according as they are exposed to the elements or not.

Coal has greater heating capacity than wood. Alexander Watt says that the heat disengaged during consumption is double that of wood. He does not, however, tell us the quality of coal used in making his tests or the kind of wood. Without this information, his figures are more interesting than valuable.

Some woods have double the heating capacity of others.

The rapid and general use of coal for locomotives has made the value of wood as a fuel largely speculative in most localities. However, many roads still use wood.

In Mexico, the hardy, scraggy mesquite is used where it can be procured. It is also better for ties than any other wood in that country.



Carriage in Burmah.

Some of the roads operating in the great timber districts of the United States still use wood for fuel. The cost per cord delivered on the track is very low. But to this must be added the expense of sawing, transferring, piling, etc.

Valuable woods for heating purposes are hard maple, hickory, beech, hemlock, ash, oak, and so on.

Maple may be used to advantage before being entirely seasoned.

The resin in hemlock makes it a desirable fuel.

Hickory is one of the best of woods, but unfortunately is very rare.

Desirable wood can be procured only in limited quantities. It is necessary to eke out the supply with inferior qualities.

Some woods are so susceptible to moisture that a heavy dew renders them unfit for use until they have had time to dry.

Certain kinds of wood dry so slowly that, when corded, the outer layers decay before the interior of the pile is seasoned.

Swamp elm will not cure at all.

Many kinds of wood have little more heating capacity than paper, and are thrown aside by firemen, as is the slate found in coal.

The substitution of coal for wood, while it has not reduced cost in every case, has much simplified the question of fuel supply, rendering it possible for the bulk of our railway companies to procure what they require from day to day. They need only keep on hand over and above current

wants, such supply as is necessary to meet the contingencies of blockades, strikes, delays, and other accidents of business. The amount will vary. Some companies find it advantageous to lay in a winter's supply in advance; others a more limited amount. Practices are not uniform.

Where wood is used, a large supply must be kept on hand, as the cost of cutting and hauling is much cheaper at one season of the year than another, while a considerable time is required to season it for use.

All kinds of bituminous coal commence to deteriorate in heat producing qualities as soon as mined. The loss varies according to quality and climate. If properly protected, depreciation is generally slow; in some cases merely nominal for a considerable period.

Coal contains more or less moisture. It is not absorbed from the atmosphere, but is inherent.

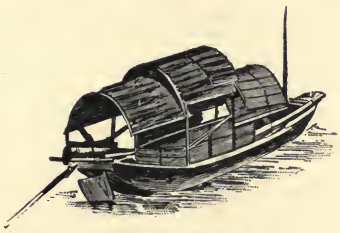
Some kinds of coal are so damp when taken from the ground as not to be fit for use until dried.

In high altitudes, where the weather is warm and dry, the disintegration of bituminous coal is so rapid as to destroy its value within a few weeks after being mined. Throughout the greater part of the United States and Europe, however, disintegration is comparatively slow. In fact, the length of time soft coal may be preserved depends largely upon the care taken to protect it.

When the mass is sufficiently great to preserve the interior from atmospheric action, the deterioration is still less.

If bituminous coal is left exposed to storms, the deterioration is immediate and rapid, multiplying in intensity with the lapse of time. A gentleman thoroughly familiar with its use writes me as follows:

"Opinions differ in regard to the depreciation of bituminous coal, even among those who handle it daily, and when called upon to state the percentage of depreciation, the most surprising differences are noticed. Much depends upon the weather. If in midwinter the air is dry and steadily cold, the loss will not be so great as it would



Carriage in Canton.

be if there were light snow or rain with occasional sunshine. In summer rain and sunshine accelerate destruction. I was inclined at first to say that the loss of coal for one month, if properly sheltered, would be nothing during the summer season. This is not true, however. There is a loss sustained, even during so short a period, not so much from atmospheric depreciation, however, as from handling. It is first thrown from the cars into the stock shed. If the shed is one half full or more, it must then be thrown to the back side of the shed. When needed for use, it must be shoveled into a bucket before being

thrown into the tender. Under this handling the coal rapidly disintegrates, and the result is that more or less of it crumbles into dust. I place the depreciation of bituminous coal at eleven per cent. for six months when exposed, and at eight per cent. when not exposed. Recently, in cleaning up a coal shed, I found the loss to be as stated. The coal was badly slacked, and when used went through the fire box and flues like so much chaff. The harder an engine is worked, the more difficult it is to keep the slacked coal (dust) in the fire box. In many cases it does not ignite at all, or ignites as it is passing through the smoke stack, or even after it has left the latter. The heating capacity of such fuel is merely nominal under the most favorable circumstances."*

As he states, the ratio of depreciation is a subject of dispute. No two agree. I am inclined to think that he under, rather than over, estimates the loss. However, his experience and observation make his estimate of value. If the table could be continued, it would be found

* He submits a table in which he estimates the weather waste of bituminous coal at Chicago as follows: M. M. K.

TIME.	SUMMER.		WINTER.	
	EXPOSED.	UNDER COVER.	EXPOSED.	UNDER COVER.
One month.	Two per cent.	Very little.	Three or Four per cent.	None.
Two months.	Three and a half per cent.	Two per cent.	Four and a half per cent.	Very little.
Three "	Four and a half per cent.	Three and a half per cent.	Five and a half per cent	Two and a half per cent.
Four "	Six per cent.	Five per cent.	Six and a half per cent.	Four per cent.
Five "	Eight " "	Six and a half per cent.	Seven and a half per cent.	Five " "
Six "	Eleven " "	Eight per cent.	Ten per cent.	Six " "

that depreciation was much more rapid after six months than before.

When we consider the relation that cost of fuel bears to total cost of operating a railroad, the importance of the loss from depreciation becomes manifest. It is a constant reminder to the officials of railroads of the necessity of keeping the supply on hand as small as possible and of throwing around the stock every possible safeguard.

In reference to the qualities of coal and their condition under different circumstances, the following communication* affords much interesting information:

"In regard to the weathering or depreciation in value of coal after it is mined, there is but a small amount of reliable information. To carry on such an investigation as would yield accurate results requires a great deal of time, and but few chemists have ever undertaken the task. Most of the investigations, the results of which have been published, were carried on by German chemists at the German universities. By the term weathering or weather waste of coal is meant the deterioration in value which coal undergoes when exposed to the air under various circumstances. This deterioration is due to the action of the oxygen of the air upon the carbon and hydrogen of the coal, and also to the decomposition of the impurities of the coal, chiefly iron pyrites, which are always found in greater or less quantity mingled with the coal.

* From G. M. Davidson, Analytical Chemist (for which I am much indebted to him).

"The composition of bituminous and anthracite coal varies greatly.* When coal is exposed to the air, the chemical changes which take place are as follows: The coal absorbs oxygen from the air. A portion of this oxygen combines with a portion of the carbon of the coal, forming carbonic acid gas; another portion of the oxygen unites with part of the hydrogen, forming water; another portion of the oxygen combines with various organic parts of the coal and the remain-

Carriage in South America.

der is used by the iron pyrites and forms oxides of iron and sulphuric acid. This acid at once unites with any lime, clay, etc., which is present, and is soon washed out if the coal is exposed to the weather, but appears as white streaks if the coal is kept under cover. The effect of weather-

*

	Bituminous.	Anthracite.
Carbon	75 to 80 %	90 to 94 %
Hydrogen	5 to 6 "	1 to 3 "
Nitrogen	1 to 2 "	1 to 3 "
Oxygen	4 to 10 "	1 to 3 "
Sulphur	0.4 to 3 "	.....
Ash	3 to 10 "	3 to 4 "

ing is to diminish the carbon and hydrogen and increase the oxygen in the coal. The organic or combustible part of the coal is decreased, and the ash or inorganic part is increased. The heating power of the coal, and consequently its value, is thereby diminished, and when the coal contains more than a trace of iron pyrites, disintegration or slacking takes place owing to the fact that the products of the oxidation of the pyrites occupy greater space than did the pyrites, and in a short time the value of the coal is very much diminished. The deterioration of coal due to the action of the oxygen is increased by elevation of temperature, and takes place even when the coal is dry. The deterioration due to the oxidation of pyrites requires the presence of moisture. Hence the greatest deterioration to coal occurs when it is exposed to the action of the weather during the hot months, and the least deterioration when it is under cover during the cold months. Prof. Grundmann, of Tarnowitz, by analyzing coal before and after exposure to all conditions of weather, in a pile of about three hundred tons, found a loss of volatile matter of 58 per cent. in nine months. Another sample of the same coal protected from rain and snow lost 43 per cent. in nine months. Both samples lost their power of cokeing in two to three months. He found that the decomposition takes place in the middle of the pile the same as on the surface, and that the rate of deterioration reached its maximum about the third or fourth week, and that one-half the total oxygen absorbed was absorbed during the first fourteen days. He also states that coal poor in oxygen absorbs it most rapidly. Coal which he examined when freshly mined and found would

make good coke after exposure, either would not coke at all, or made a very poor quality of coke. Prof. Varrentrapp, of Brunswick, found by his investigations that the oxidation of coal takes place rapidly at ordinary temperatures when moisture is present. He found the weather waste in some cases amounted to 33 per cent., and in one instance decreased 45 per cent. in gas yielding qualities, and 47 per cent. in heating power, while the same coal kept under cover lost in the same time 24 per cent. for gas purposes, and 12 per cent. for heating purposes. These experiments were made with German bituminous coal. In regard to the weathering of anthracite coal, I find that the general opinion of chemists is that it is but very little if at all affected by exposure to the weather. Lumps of anthracite have been examined which have been exposed to the weather for thirty years and found to be first class fuel. In regard to the effect of the weather on bituminous coal, nearly all varieties deteriorate to a great extent when exposed to the air. This deterioration is greatly favored by high temperature and, in coals which contain iron pyrites, by moisture. In coals free from iron pyrites this deterioration seems to be as rapid when the coal is dry as when it is wet. It is always increased in all kinds of bituminous coal by increase of temperature, and is more energetic when the coal is in dust or slack, especially when it is accumulated in large heaps which are without ventilation, and so retain nearly all the heat which is developed."

The quality of coal from no two mines is alike; nor, indeed, from different parts of the same mine.

These differences destroy, to a certain extent, the value of tests made of a particular coal so far as they apply to other coals.

Differences in the quality of bituminous coal are more marked, probably, than with most other materials. Engineers tell us that coal from a particular district burns easily and uni-

Carriage on the Rhine.

formly, and is a good steam producer; that another is fair, but not so good; that another contains too much sulphur; that another is lacking in vitality; that another has so much slate as to be worthless; that another is too damp, and so on.

The great value of the practical knowledge that engineers and firemen have of the fuels

they use is well known by railway companies, and is taken advantage of to the utmost in buying and using.

Many railway companies make systematic efforts to instruct their enginemen in the scientific use of fuel; in the laws of combustion; in the economical generation of heat; in the effective use of fuel in making steam. They are repaid for their efforts by material reductions in the cost of fuel per unit of service.

Coal is more destructive to the fire box of a locomotive than wood, because of the sulphur and gases it contains. The gas is greater in hard than soft coal.

The peculiar features that attend the use of different kinds of fuel and the fact that no two kinds possess the same heating capacity, make their use a matter of experience and study. If the adaptability of a fuel is not known, wastage will occur as a matter of course.

When the kind and quality of fuel is the same, differences will arise on account of differences in the ability and disposition of firemen. It is estimated that there is thirty per cent. difference between a good and a poor fireman in the fuel used. It will be seen, therefore, how important it is that a company should have good firemen, should be able to distinguish between good and poor firemen.

Those familiar with such matters assert, and truly, that each engine has peculiarities that must be observed in firing, if efficiency and

economy are to be secured. This is impossible, it is manifest, if firemen are constantly changed from one machine to another. Not only will they not possess requisite knowledge of their work, but power to hold them responsible will be lessened, and, in many instances, totally wanting. Moreover, under such circumstances men will not feel the interest in their work that they would if it were carried on more systematically and with a more intelligent view of increasing their knowledge and sense of attachment.

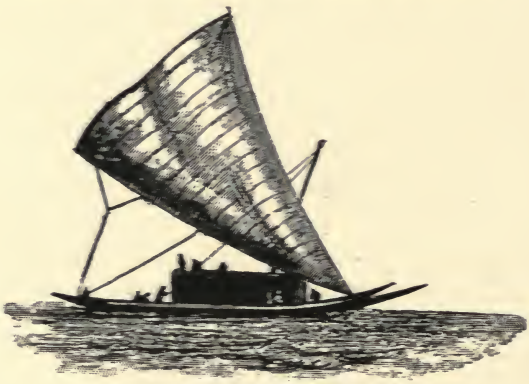
In order to secure the highest results obtainable in the use of fuel, scrupulous observance of every necessary detail must be practiced. The fireman must be familiar with the fuel he uses; also the peculiarities of the locomotive he fires.

The performances of firemen should be studied and their efforts compared, not generally and cursorily, but exhaustively and minutely. As this work increases in extent by the growth of a road, there will be a disposition to neglect many details. It must not be forgotten, however, that a company will be the loser thereby.

The multiplication of engineers and firemen upon a railroad should be attended by the multiplication of methods of supervision. Upon a small road the work may be done by the manager or master mechanic, but when the time of these officials is otherwise fully occupied, the duty must be delegated to others and must keep pace with its volume and importance.

More or less of the heat energy of fuel escapes. This must be prevented so far as possible. The economical use of fuel depends on men and machines. A storekeeper whose opportunities of observation are extensive, writes me in regard to the use of fuel, as follows:

"A vast quantity of fuel is wasted through imperfect knowledge of the art of firing. How to teach men to extract the greatest amount of heat



Carriage in the South Sea Islands.

from the least amount of fuel, and put in practice such knowledge, is a thing that suggests itself to every railroad manager. I would suggest the appointment of an officer who understands the principles of combustion, and who is endowed, moreover, with the faculty of teaching and influencing others. It should be the sole duty of this man to instruct employes in the use of fuel and oil; to make the work his exclusive study. Not only should men be verbally instructed in the

use of fuel, but they should be provided with a concise formula setting forth the principles. These formulas should not only be learned by those who actually perform the work, but by those whose duty it is to employ such men or supervise their work."

In the economy of fuel the engineer plays a part as important as the fireman. His method of using steam economically, feeding the water to his boiler, and so on, have a marked effect on the amount of fuel used. The fireman, to be efficient, must understand the principles of combustion; must appreciate the importance of a proper supply of air to his fires; must be careful not to allow the grates to become choked with cinders and clinkers. So important are these facts that some railroads have adopted a regulation by which half of the saving in fuel effected by the care of the engineer and fireman is divided between them. The amounts thus paid are considerable. Not only are the results arrived at valuable, but an incidental advantage is also secured, namely, the abatement of the smoke nuisance, which is largely the result of imperfect firing.*

Fuel is the most difficult of all material to care for; its general use by the community makes its possession a matter of common concern. But if it were never stolen except by those actually suffering its loss would be less aggravating. Unfortunately this is not the case. From the time it

* The duties of firemen are more fully referred to in another volume.

leaves the mine until used, it is subject to the depredations of pilferers. It is thrown from the cars while en route, and is surreptitiously taken from the yards, storehouses and locomotive tenders. Nowhere is it safe for a moment except within secure enclosures. These facts are thoroughly understood, but lack of proper facilities for storing renders it impossible to avoid loss in many cases.

When wood was more generally used, the poverty of the companies and the enormous supply required to be kept on hand rendered it impossible to place it within secure houses or yards. Better provision is possible for coal. A certain percentage of loss occurs, however. This loss is sufficient in many, perhaps the majority of cases, to warrant the construction of secure storehouses or the employment of watchmen.

The general disposition evinced to erect secure buildings where only sheds and open yards before existed, is an evidence of the appreciation of the subject by railway companies.

The fuel supply of a railroad should be quite as inaccessible to the public as its other material. The annual expense for maintenance and interest on buildings that this will involve will be slight compared to the losses that will occur where precautions are neglected.

Coal has many advantages over wood besides those I have mentioned. It is, as a rule, cheaper; is not so subject to the danger of fire; is more compact, and simpler to account for.

Wood involves exceptional expenses for inspection, supervision, depreciation, handling, accounting, etc.

The cost of fuel forms a large percentage of the expenses of a railroad. It is increased or lessened according to the intelligence and fidelity exercised in purchasing, caring for and using. Much thought has been given its use. Employes have been stimulated in every way to exercise economy. In many cases rewards are offered for those who show the greatest intelligence and care.

The methods of accounting for fuel are not uniform. One very good system provides for furnishing those who use coal or wood with tickets for different denominations. Thus, upon the delivery to a particular locomotive of two cords of wood, a ticket for the amount is given by the engineer to the storekeeper. The same rule is observed in regard to coal. This plan works very well, but it is not in all respects satisfactory. The number of tickets that must be kept on hand in the operation of a road is so great as to render accurate handling exceedingly difficult. The tickets received in exchange for fuel are assorted and distributed again and again. In this process tickets for different engines are frequently mixed. Moreover, engineers are not always able to guard them properly while in their possession. The rivalry that exists as to who shall do the most work with the least fuel leads to irregularities; to the taking of fuel with-

out giving a ticket in return; or the use of tickets of other locomotives. These and other difficulties disturb the fuel accounts.

It has been suggested that a blank form would be better than a ticket, the different kinds of fuel being printed on the blank so that the recipient of the fuel can note down quickly the amount opposite the kind received by him. This

Carriage on the Yang-tse-Kiang River.

would do away with the redistribution of tickets and greatly lessen the embarrassment of handling. I am inclined to think this the best plan. If the engineer or person is careful, he can render it impossible for anyone to counterfeit the receipts he gives. This is important. Moreover, after the receipts have been used in auditing the account, they may be returned to the person who

gave them so that he can assure himself that nothing has been charged to him improperly. This plan will not only reduce labor, but prevent many of the impositions that are practiced where tickets are used.

The kind of fuel receipt used by engineers will also do for conductors, station agents, and others who have occasion to use fuel.

The practice upon some roads, particularly upon English lines, is for the fuel agent to exact a receipt for the fuel he delivers. He writes the receipt. It is elaborate and formal. He also gives a statement of the amount at the same time to the person to whom he delivers the fuel. This plan is admirable where time and clerical facilities permit. In other cases, that previously described is the best. Wherever the latter is enforced with reasonable intelligence and certainty, it will secure accurate accounting so far as appliances for handling fuel permit. The haste, however, with which fuel is loaded, and the impossibility of being entirely accurate as to quantities, will, as is well known, always create more or less differences in the fuel account. They are important, however, only so far as they render it possible to determine as to the economical use of fuel. But as this is a matter of the greatest concern, it must never for a moment be forgotten.*

* For a full description of the details of accounting connected with the handling and use of fuel, see volume "Fiscal Affairs, Disbursements."

In order to determine the measure of economy exercised by employes, careful comparisons should be made of fuel used on different locomotives for the same month and for the same line and for different lines. Comparisons should also be made of the consumption of the same locomotives for different months. Similar comparisons should be made for the fuel used at stations, in cars and elsewhere; wherever, in fact, conditions are similar or the zeal of operatives may be increased thereby.

The method of buying and handling fuel varies according to the experience, talent and prejudices of men. Thus, upon some lines it will be handled wholly by operatives; upon others, the work will be done wholly by contract. Both methods have their advocates, and are successful according to the measure of intelligence and energy exercised.

In reference to the custodianship of fuel, that at stations is very generally entrusted to the care of the agent; at shops and elsewhere, to the storekeeper. The supply of fuel that a company must keep in stock will depend upon circumstances. If necessary to lay in a supply ahead, requisitions should be made far in advance, so that provision may be made for buying and shipping to the best advantage. A greater stock of fuel should never be carried than circumstances render necessary. The loss from depreciation, if nothing else, would render such a course the best.

CHAPTER XVII.

REGULATIONS ATTENDING THE STORAGE AND DISBURSEMENT OF MATERIAL.

Material should be disbursed only on orders properly signed.

Disbursements should take cognizance of the article, quantity, time, manner and use.

The higher the degree of intelligence and interest evinced by the disbursing agent, the greater the care in ordering and using.

Orders should be filled under the direction of a particular person.

Orders, like bank checks, should be filled up solidly, no blank spaces being left for subsequent additions.

Orders should be delivered before the material is taken from the store. An English rule provides that "any workman desiring material of any description, including deals, planks, battens, timber or scantling, and taking them out of the yard without first making application for them at the office, will be discharged."

Orders should specify the name of the person to whom the material is to be delivered, and, if possible, the name or number of the workman who is to use it. An effort should be made to particularize the transaction; to make all con-

cerned feel the responsibility that attaches to their actions.

Orders should be signed by the foreman and, if possible, countersigned by an official having cognizance of the facts; they should be definite as regards article and quantity; thus, they should not read for "nails," but should specify the kind

Carriage on the Canton River.

and quantity. Such things seem trifling, but they are important and matters of every day occurrence.

Orders should specify the use to which material is to be put, and the account to which it is to be charged. This information is necessary for writing up the accounts. It is also necessary to

enable the storekeeper to judge of the expediency of an order as regards quality and quantity.

Orders should be carefully filed and preserved by the storekeeper; they form the basis of his accounts and justify his action.

In distributing material, that which is oldest or most likely to decay should be used first; this is especially necessary with lumber, timber, fuel and similar supplies.

Those having charge of disbursements should be familiar with the stock. They should also be experienced, if possible, in the needs of the service, so that they may not only anticipate its wants but judge of the interest and care that is exercised by those who order and use material. It is desirable that a particular man should be assigned steadily to this work. If it is not sufficient to give him constant employment, he may be assigned other duties, but this should take precedence of everything else.

The person making disbursements should be skillful. He should not only be familiar with the use of material, but know how to load it into cars and pack it into boxes and otherwise arrange it. When such work is performed by an inexperienced person, damage is likely to occur from imperfect loading or packing; it is also unnecessarily costly. In loading goods reference should be had to unloading; the total cost should be considered.

Orders for material should be carefully scrutinized by those experienced in such matters.

They should be reduced to the minimum in every instance.

When disbursements are in excess of needs, it encourages careless handling and improvident use. When the amount delivered is only sufficient to cover the work in hand, economical use is necessary; if in excess, a margin is left for waste.

The duty of storekeepers, as already intimated, does not end with the filling of the order; with the delivery of the material. Their duties require that they follow it into the workshop; into the hands of workmen; to see that it is used as stated; to take note of those who use it extravagantly; of those who use it prudently. They must remember, too, that it is as necessary that the latter should be recognized as that the former should be punished. Raw supplies disbursed for use in the manufacture of goods remain especially under the supervision of the storekeeper. It is his duty to look after them; to watch their disposition; to see that they are accurately accounted for.

In shipping supplies, ingenuity must be exercised to do so at the least expense and inconvenience to the company. Thus, if goods, in small quantities, are to be shipped by freight train, they should be taken to the station and way billed the same as freight; if in car lots, they may be loaded at the storehouse if more convenient.

When material is shipped to local points in small quantities, it should be forwarded in the

baggage car or as way freight; the impolicy of using a car in such cases is apparent. It is, however, frequently done, because of the fact, probably, that the property belongs to the company.

The prudent use of a company's equipment is all important and must never be lost sight of.

In order to facilitate petty shipments of supplies, storekeepers should provide themselves with suitable boxes and appliances. These they may use over and over again.

Orders for material should not be made greater than necessary to save the labor of frequent shipping. The economical use of material will be better assured if the supply is so small that the person using it is constantly reminded of the scantiness of the store and the necessity of its being carefully husbanded.

The number of storehouses should be restricted as much as possible.

The small supplies used at isolated roundhouses, local car repair stations and similar places, can be accounted for to the nearest storehouse, and returns to headquarters made therefrom. There is no occasion for establishing petty depots for such material.

Undue disbursements of material prevent accurate knowledge of the amount on hand, and have therefore a tendency to swell the same.

Material is nowhere so safe as when in charge of a storekeeper.

It is the same as money; when received, it should be inspected with care; when in store, it

should be watched with vigilance; like intelligence should attend its disbursement.

Neither too much nor too little should be given out. A cashier knows that if he pays money not

Carriage in Siberia.

called for by his voucher, or if he loses the latter or neglects to record it, his cash will not balance. This is also true of the storekeeper, except that in the case of the cashier his balances tally to a

cent if proper care is exercised, while in the case of the storekeeper discrepancies are inevitable, because of differences in prices, measurements, averages, etc. But if he exercises care the amount of the discrepancies will be trifling.

In disbursing material the charge should be on the safe side, *i. e.*, it should be enough, but not excessive. A comparison of the inventory at the close of the year with the balance standing to the debit of a storekeeper, will (after making allowance for differences in prices, measurement, etc.) afford a very fair indication of the care and intelligence he has exercised.

Every company should, if possible, have a general storehouse from which material may be supplied to lesser storehouses as needed. It will also serve as a local depot. Its judicious use will render it possible to reduce the supply of material to the minimum. In the absence of such a depot, the disposition will be general for every storehouse to multiply its necessities. But if the orders of local storehouses can be filled at a moment's notice from a central store, such storekeepers can be made to restrict their orders to current needs. They will not only have no motive to increase their stores unnecessarily, but will be encouraged to decrease them so as to save labor and responsibility.

In reference to the disbursement of supplies for local use at night, or in the absence of the storekeeper, a capable and trustworthy person should be selected to perform this duty. He should

be governed by the rules and regulations applicable in other cases. If proper forethought is exercised there will, however, be very little demand for such supplies. But in order to meet unavoidable cases, provision must be made. Lubricants and tools for locomotives will be most in demand at such times. A good plan in the latter case is to provide a cupboard in the roundhouse in which to keep an assortment of tools for use as required, but which may not be disturbed without the return of the old tools, or compliance with the rules governing in the case.

To facilitate the easy shipment of stores, it is desirable that there should be a track on each side of the storehouse, but it is of even greater importance that the floor of the storehouse should be on a level with the floor of the car. One man can under such circumstances perform as much labor as two men under other conditions.

In shipping material, an invoice should accompany or precede it. This invoice should be receipted and returned in every case.

In filling orders for tools, the invoice should be accompanied by a duplicate, which the recipient should retain for reference. Care should be exercised to see that orders and invoices are duly entered and charged. However, these details, as well as others of a generally similar nature, are referred to elsewhere.*

* See also chapter on Construction Material, elsewhere herein. For particulars in reference to methods of accounting for material disbursed, see volume "Fiscal Affairs, Disbursements."

CHAPTER XVIII.

CARE AND STORAGE OF STATION AND TRAIN SUPPLIES.

Many of the articles furnished employes are of so little value that, considered apart, they do not seem to justify the cost of watching over them, of counting and inspecting, of keeping a record of their disbursement and use.

Nor are the benefits of such watchfulness at first apparent. It is, however, both necessary and valuable. Experience has proven this.

We must take cognizance of every article disbursed. In some cases, notably that of stationery, the value of the article, considered by itself, seems not to justify it. But the aggregate value, coupled with the necessity of supplies being prudently used and carefully guarded, warrants it, even if the spirit of economy it inculcates does not. This is true of the blanks of railways as much as it is of more costly articles.

In distributing articles to replace others, such as water buckets, glasses, dippers, lanterns, brooms, inkstands, erasers, cuspidors and kindred property, the old article should be returned as required in the case of tools and brasses described elsewhere.

The rule is a valuable and necessary one.

Carriage on the Ice.

It should be observed wherever the return of the old article will prove that it has not been lost or misappropriated.

The rule of exchanges is a simple, inexpensive and practical one; one that everybody can understand and easily live up to. Its enforcement will ever prove instructive and valuable.

To make the supervision of train and station supplies effective, an account should be opened with each person to whom they are furnished.

Orders for supplies should be scanned to judge of the economy that has characterized the use of preceding disbursements as well as the propriety of the present request.

An account in dollars and cents need not be opened with each employe, but a record of the articles should be kept. To facilitate comparisons, blanks, instead of books, may be used if thought better. It is not necessary to go into elaborate bookkeeping. The method of keeping the account should be made subservient to the purpose it is designed to serve, namely, to see that orders are restricted within reasonable limits, and that supplies are carefully husbanded and used. The record is of no value further than this, and the simpler it is, the better.

An employe should not be able to order articles such as we are treating of from more than one storekeeper. Such restriction will simplify supervision and heighten responsibility.

If allowed to order from different storehouses, storekeepers should be required to report their

disbursements to a particular official so that somewhere a full account may be kept of the supply furnished each individual. The same rule, in fact, should be observed as that suggested elsewhere in connection with tools.

Orders for station and office supplies should cover a month's needs.

In the case of stationery, three months' supply may be ordered to advantage except when the consumption is great.

Orders should be restricted to the amount that can and will be carefully cared for and economically used.

Careful comparisons of supplies consumed should be made.

In the case of fuel, oil and similar supplies, the known needs of the person making the order will guide the storekeeper in making disbursements.

Excesses of every kind should be promptly repressed or investigated.

Reference has been made elsewhere to a plan for supplying stations monthly with oil, from a tank car sent over the road for that purpose. It has been suggested that station and office supplies may also be distributed from a car sent over the road monthly, thus completing within a day or two at slight expense what otherwise would require weeks. The car could be fitted with compartments adapted to its use. Such a plan would, in many cases, save packing, and by providing racks for lamp chimneys and kindred

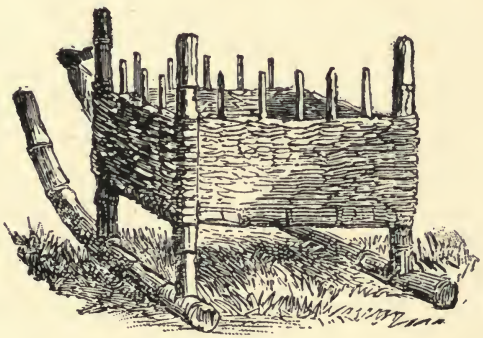
articles the necessity of boxing, as at present, would be avoided. It is believed that considerable expense might be saved in this way.

The value of articles, tools and other appliances in the hands of agents and conductors is so great as to warrant the designation of a person to look after them. This is especially true of large stations, wrecking trains, and dining and sleeping cars.

In the case of car tools and appliances, the frequent changes among train men make it difficult to fix responsibility for property of this nature. It is frequently overlooked or unavoidably left behind in the case of accidents and detentions and is liable at all times to be stolen without anyone being to blame. It is exceedingly difficult to follow the use of train tools or trace their loss. But reasonable responsibility may be secured by inventorying the supply at the end of each trip. In case of loss, the burden of proof rests on the person in charge. This will compel him to examine the supply turned over to him by his predecessor and to watch it while in his hands. Both of these things are as necessary to the safety of the public as they are to the careful husbanding of a company's property.

The value of careful accounting and a rigid enforcement of the system of exchanges I have described, applies to all classes of appliances; to the cooking utensils, crockery, silverware, napkins, and other appurtenances of dining cars; to the food, cigars and liquor with which they

are stocked; to the blankets, linen, toilet articles and other appliances for sleeping, drawing room and business cars; to the tools and accessories of wrecking cars; to the fuel, oil, stationery, trucks and tools in use about stations; to the implements in the hands of trackmen; to the axes, saws, hammers, coal buckets and lanterns of passenger and baggage cars; to the switch ropes, jack screws, wrenches and other implements of



Carriage in Manilla.

caboose cars; to hammers, files, chisels, oil cans, packing hooks and other articles of locomotives; to the tools of carpenters and machinists; to every kind of portable property, in fact, in the hands of employes.

The number of articles would fill a volume. I shall not attempt to describe minutely methods of accounting. I design simply to lay down the principles that should govern and indicate generally their method of application. However, it

must not be forgotten that methods must adapt themselves to cases. Thus, a system of returns that will prevent loss or misappropriation of tools in the hands of machinists would require considerable elaboration to compass the needs of dining cars, where the utensils are much greater in number, value and general adaptability.

In the case of dining, commissary and sleeping cars, the person in charge should be held responsible for utensils. He should be debited with articles supplied him, from the rug that lies on the floor to the silver tea pot that sits on the supper table. At the close of each trip he should be required to report the number of articles of each kind on hand at the date of the last return; the number received since; the number delivered up; the number destroyed or lost (with an explanation in each case) and the number on hand. A similar return should be made of articles of food; thus, he should report the number of pounds of bacon on hand at the close of the last return; the number supplied him since; the number he has purchased; the amount consumed; the amount otherwise disposed of, spoiled or lost, and the amount on hand. In the case of liquors, he should make a similar return except that he should substitute bottles, quarts, pints, and so on, for pounds.* Values should also be given in these returns.

*For form of return made by dining car conductors, see Form No. 4, Appendix.

The returns need not be entered on any book or record. They are a record in themselves. Upon receipt of a return the storekeeper should refer to the preceding report to see that the amount therein stated as on hand agrees with the amount brought forward. He should then examine to see that the return agrees with the supplies furnished; that the return of articles purchased, used, returned, damaged, destroyed, on hand, etc., is true, so far as he can determine.

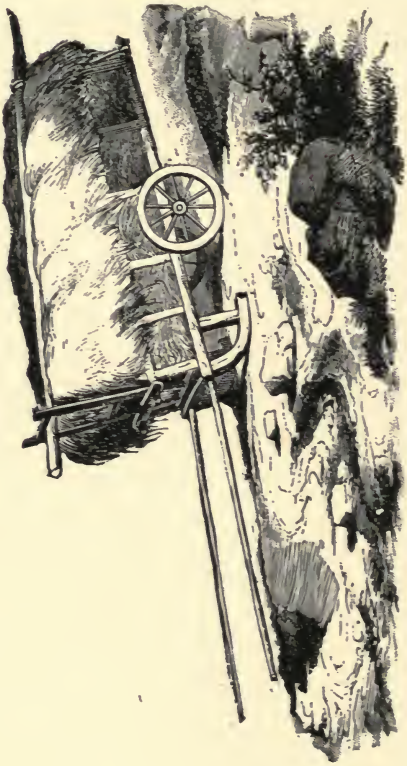
Each return should be a full history, and after being examined should be filed away. It should be at once a statement of the property and an inventory. The storekeeper should verify its accuracy as often as once a month by personal inspection. Linen should be inventoried at the close of each trip. In taking this inventory, the unsoiled articles should be first counted; those that have been soiled should then be assorted and counted, after which they should be turned over to the laundry, the inventory serving not only as a record, but as a charge against the laundry.

No particular day should be designated for taking inventories of articles in the hands of dining car and similar officials. It should be done at infrequent periods, daily if thought necessary, but never more than a month apart.

In the case of dining, sleeping, commissary and similar cars, losses will occur through the carelessness and improvidence of employes, no matter how careful the discipline. It is the cus-

tom to require the delinquent to pay for such property, except in the case of glassware and crockery, when ordinary risks are borne by the company.

In reference to accounting, it should be frequent, simple and comprehensive; such as to suggest care and enforce responsibility. The general form of return suggested for reporting articles used on dining, sleeping and commissary cars is well adapted for the use of agents, track foremen, trainmen and others. It does not necessitate bookkeeping and is cheap, simple and comprehensive, and furnishes a complete statement of property.



Carriage in the Alps.

CHAPTER XIX.

ARRANGEMENT OF SUPPLY DEPOTS, INCLUDING YARDS FOR CONSTRUCTION MATERIAL—COLLECTING, STORING AND DISBURSING.

[NOTE.—Many of the suggestions contained in this chapter are applicable to common storehouses and yards and, in so far as this is so, should govern.]

The facilities a construction supply depot will require will depend upon the amount of material to be handled and the length of time the depot is to be used. If it is temporary, and the amount of material small, the facilities may be simple and inexpensive.

In many things depots for construction supplies are the same as those for handling operating material. The regulations governing the latter are also, generally, applicable to them.

In arranging a depot for construction material the office and storeroom for small supplies should be located so that the work may be generally overlooked by the storekeeper in charge.

As the storehouse and office will be only temporary, they should be constructed with that view, and with the least possible damage to the material used in its construction.

In arranging tracks for distributing material, the upper end of the first siding may be used for storing material for buildings; further on for rails; still further on for track fixtures, arranged and classified, with a view to being loaded on the cars with the rails. The second side track should be used for ties; this track, and those beyond, if the amount of material to be handled is small, need only be connected with the main track at one end; when the space between the first and second siding is filled with ties, the track may be crowded over and another rank laid, and so on. Afterward, as fast as a rank is loaded and shipped, the track may be crowded toward the center again, and thus the material may be reloaded without the necessity of being carried far.

Each kind of tie should be kept separate.

Switch material, including frogs, stands, rods and headblocks, should, so far as possible, be kept together for use simultaneously.

Rails, for convenience and economy, may be piled on racks made of ties; the foundation must be solid and level.

If the amount of bridge material is not large, it may be stored at the lower end of the first siding, where it can be put in shape for use before leaving the yard.

In storing material, different dimensions, sizes and kinds should be assorted and piled together; thus, boards or rails of unequal length, or timbers of different dimensions, or ties intended for different purposes or locations, should not be piled to-

gether, but so separated that each may be conveniently reached when needed.

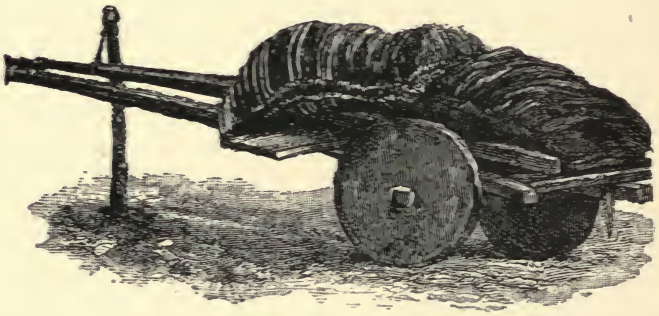
If sidings incline slightly in the direction cars are to go after being loaded, it will facilitate moving them without the aid of locomotives and cheapen cost of handling.

If the depot is located at a point where sidings are not sufficient for switching empty and loaded cars, it will be necessary to make special provision; in such case, a track may be laid parallel with the main track and between it and the first siding.

In shipping such material as ties, rails, switches and track fixtures, the exact quantity required may be determined, unaided, by the storekeeper in advance. Material for bridges and buildings, however, will require specific orders in each instance as regards kind and quantity, otherwise waste will ensue; my attention has been called to an effective means of handling this material: the engineer in charge furnishes the storekeeper with a list of the material required for particular kinds of structures; with this he deposits a sketch of each kind and class of structure, showing it when completed; when he requires material, he designates the diagram of the structure wanted. This plan enables the storekeeper to fill the order without error or waste, and consequently at the minimum cost; to send timber of the right length and dimensions, and in the right quantity; boards of the right kind and amount, and so on; each structure is, in fact,

shipped complete, supplies tallying exactly with the wants of the builder.*

Orders for material should be addressed to the storekeeper. He should also be furnished with copies of requisitions when made; should know when supplies will be needed; the probable time of their receipt, and so on. He must also know whether they are to be unloaded in the yard or sent to the front as received. He must, in fact,



Carriage in Asia Minor.

with the engineer, understand all the details connected with the material to be used, so that he may make needed arrangements in advance.

The necessity for forethought and energy on the part of a storekeeper is very great. He must ensure the arrival of material in due season and prevent its being received and shipped to the front without inspection and entry on his books.

* The reader is referred to the volumes "Financing, Building and Maintaining" and "Fiscal Affairs, Disbursements" for details of construction not embodied herein.

He must see that material is unloaded with a view to economy in handling; that in loading, due thought is given to the easy and rapid movement of material at the front.

Orders on the storekeeper must be given in advance, so that material may reach its destination at the right moment.

Orders for material must state explicitly for what the material is to be used.

In unloading at the front, all empty packages should be reloaded and returned to the storekeeper for future use or disposition.

Material should be inspected as in other cases, except that greater care must be observed if possible.

Upon receipt of invoices, they should be compared with requisitions to see that orders have been properly filled; for this purpose, invoices should, if possible, be sent in advance of the goods.

When material is sent to the front without being inspected, instructions must be given accordingly, and it is the duty of the storekeeper to see that the work is performed subsequently by a trustworthy person.

In forwarding construction material to the front, the storekeeper should give the order to ship to the foreman of the yard; it should be explicit as to the thing required, name of consignee, place, purpose, etc. The foreman of the yard should carefully measure and inspect the material and furnish the data required for way billing.

Each shipment should be way billed, and the name of the conductor inserted on the bill. The bill should be receipted by the person to whom the goods are consigned, and the purpose for which the material is to be used stated thereon by him. The bill (or a copy thereof) should then be sent to the forwarding storekeeper to afford him the data he needs for his accounts, and determine the thing to be charged.

The yard should be under the direction of a general foreman. When the amount of material warrants it, the force should be divided into sections and classified, each section having a foreman.

The wages of foremen need be but little, if any, greater than that of laborers. They should perform the work of laborers. The authority they possess will serve to enforce greater discipline and responsibility than could be otherwise attained at equal cost. Such disposition will also prevent jealousies. It will make men skillful in handling particular kinds of material and otherwise facilitate work.

Fire precautions should be redoubled in the case of construction depots.

Sufficient force must also be maintained to guard the property.

A storekeeper should be appointed to take charge of construction supply depots. He should be experienced and should give his undivided attention to the work.

The duty of receiving, inspecting and caring for construction material is a thing in itself.

The keeping of the time of men and the making of construction pay rolls, including the giving of discharge certificates, forms a part of the work.

Concentration is necessary to secure responsibility, thoroughness and promptness.

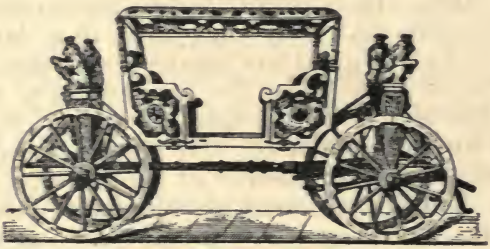
Attempt to blend the construction forces of railways with their operating forces is generally harmful. Construction work is something apart and requires peculiar talents and facilities, including those relating to accounts.

Construction storekeepers labor under disadvantages compared with those who handle operating material. Their facilities are generally limited and crude, while their assistants are, in the majority of cases, unskillful. At the same time the work must be conducted with the utmost dispatch and care.

A person of considerable experience as a storekeeper, and familiar with the methods of railroad builders, writes as follows:

"The handling of large quantities of material makes it imperative that the supply yard should be arranged with a view to economy in receiving and forwarding, as well as for convenience in handling. Under ordinary circumstances, and where there is sufficient room to admit of its being done, the yard tracks should be so laid that the more bulky supplies can be piled on separate tracks having but one class of material to each track, and so grouped that the loading and making up of supply trains may be accomplished with convenience and dispatch. As ties constitute the greater bulk of construction supplies,

they should be so piled as to ensure the greatest economy of labor in unloading and reloading, and secure protection against fire at the same time. Convenient handling may be secured by putting the ties in long parallel ranks, leaving occasional intervals of about fifty feet; the ties to be laid adjacent to and at right angles with the track, and as soon as a rank is completed for the full distance required for the tie piles, the track should be thrown over sufficiently to admit of the construction of another rank. Where this plan is adopted, however, the track can only be



Carriage in Saxony.

connected at one end, leaving the other free to be swung. By this system, ties, in either unloading or reloading, need not be carried for a much greater distance than their length. Another plan which admits of the use of both sides of the tie track for storage, and which allows a track connection at both ends, thereby making this class of material more accessible, is to arrange the piles in groups extending back to one-half the distance to adjoining track and with fifty-feet openings longitudinally at intervals of about one hundred and fifty feet. Ties in these groups should be arranged with the rank next to the

track built up to the height of the car floor. The other ranks should extend back to the required distance and at right angles to the first rank, but carried to a greater height. This plan, as compared with the former one, admits of a short parallel track being used, the advantage of which is that ties coming in box cars at the time track laying is in progress, can be transferred to flat cars (which, from their capacity for greater loads, should be used in construction) with less labor than would be necessary were they put off on the ground, thus saving their handling a second time. In addition to the force required to handle the material, the yard, if a large one, should have a good car repairer, who should have charge of all supplies for the repairs of cars and the delivery and shipment of oil and waste for train and other service. He should make a daily report to the storekeeper of all material used by him. The supply yard should be in charge of a general foreman, who should have supervision and control over the switch engine, and should be accountable for the general efficiency of the force, including the filling of orders, the general arrangement of supplies, and the proper inspection of piling ties, rails, bridge timber, etc. He should be assisted by a clerk, whose duties should be to check all supplies as unloaded or forwarded, and enter in detail the contents of each car on the yard book, and make a daily report of the same to the storekeeper. It should be the duty of this clerk to keep the time of men in the manner and form prescribed by the storekeeper."

Many of the foregoing details are well understood by those versed in railway construction,

but they are not appreciated generally by railway men. Indeed, the handling of supplies is so little understood that particulars are eagerly sought by all.

In building railroads, freight, whether consisting of construction supplies or not, should be way billed, and passengers should be ticketed; this will prevent confusion and ensure accountability.

In closing construction depots, the amount of material left over, including the amount on hand along the line and elsewhere, should be inventoried and invoiced to the storekeeper or storekeepers who will have charge of it, so that its disposition may be watched afterward.

It is impossible to prevent errors and omissions creeping into construction accounts. The result is, in some cases, a surplus; in others, a deficit. Whatever the balance may be (in closing supply depots) after deducting the value of the material on hand, it should be credited or charged, as the case requires, to the different construction accounts, in the proportion that the amount of material expended on each bears to the total amount expended.

When a construction supply depot is continued from season to season, an inventory should be taken at the close of the business year, or oftener if necessary, and the accounts made to conform thereto.

CHAPTER XX.

THE INVENTORIES OF RAILROADS: TIME AND MANNER OF TAKING.

An inventory is valuable on many accounts. It is necessary in order to adjust the books from time to time to harmonize with the facts; to make the amount charged to material agree with the amount actually on hand. Another purpose it serves is to familiarize storekeepers and others with the stock on hand; to call attention to each article; to those that are necessary and those that are not.

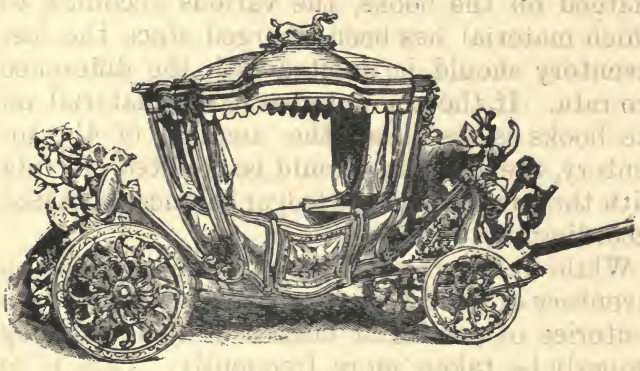
It is a review. It emphasizes the stable and weak spots.

Moreover, it is an opportune time to re-adjust prices to conform to current values.

It also serves to indicate the care that has been exercised in handling material and in keeping the accounts. If the amount varies greatly from the sum charged on the books, it indicates lack of method, either in disbursing or charging. Differences will creep into the accounts, but they are as likely to be over as under; the books should, therefore, balance practically at the end of the year. When they do not, it suggests the advisability of exercising greater care.

How often an inventory should be taken, is a matter about which opinions differ. Merchants take one yearly, and, as their judgment in such matters is above criticism, their practices may be accepted as authoritative. There may, however, be exceptions to the rule.

In the case of railroads, the proper time to take the inventory is on the last day of the fiscal year, unless it occurs when the ground is likely



Carriage in Portugal, Eighteenth Century.

to be covered with snow and ice; in which case some other day should be designated, as it is impossible to take an accurate inventory under such circumstances.

Whenever a storehouse or depot of supply is closed, an inventory should be taken of the material on hand. It should be invoiced to the storekeeper, whose duty it is to look after it.

The inventory should embrace all material in store, at shops, roundhouses, mills, on the line of

road and elsewhere, including general supplies, stationery, fuel, track material and other stores.

It should not include material or tools in use, or which have been charged to some disbursement account on the books.

When the value of the material in store has been ascertained, the general books should be adjusted to conform thereto. If the value of the material on hand is less than the amount charged on the books, the various accounts to which material has been charged since the last inventory should be debited with the difference pro rata. If the amount charged to material on the books is less than the amount of the inventory, the accounts should be credited pro rata with the surplus and the ledger balance increased accordingly.

While it may not be advisable to take an inventory oftener than once a year, special inventories of particular classes of material may properly be taken more frequently. This is so of brasses, tools, and property in the hands of employes. Such inventories should be taken as often as once a month, and as much oftener as necessary to secure care and responsibility upon the part of those who have the material in charge.

An inventory of rails and ties may be taken as often as twice a year and the books adjusted to conform thereto.

In the event of any great or abnormal change in prices, it may be wise to take an inventory to

harmonize the books with existing conditions. But as a rule, no injustice or harm will be done by waiting until the usual time.

In those cases where material is scattered about a yard, the watchfulness necessary to protect it will amount to the same thing as a daily inventory. It is only by such care that variations in the supply can be accurately noted and the accounts made to harmonize therewith, while the facts are still fresh.

Inventories of construction supply depots should be taken at the close of the building season, or, in the absence of such a season, when they will be useful for summing up results and balancing accounts.

The difficulty of taking an inventory will be great or small, according to the facilities for storing supplies. If they are inadequate, or if the material is widely scattered, or articles and classes are piled together indiscriminately, the labor will be magnified. If, however, facilities permit careful storage and classification, the work will be comparatively easy.

The inventory should be exhaustive. Every device should be used to make it thorough. The work should begin with the close of business on the day assigned. Much preparatory labor may, however, be done beforehand in arranging, classifying, weighing and counting the stores; also by inserting the names and prices of articles on the blanks used for taking the inventory. But whenever the work is done on inventory before the

day appointed, the utmost care must be taken to avoid mistakes. Care must be taken to see that if any material inventoried in advance is used before the day for taking the inventory, the correction is made.

The work of taking an inventory at a general storehouse is thus described by one familiar with the task:

"Journals or alphabetical indices are ruled, marked and labeled according to the work required, viz: one for each storeroom, one for outside material, for scrap house, for lumber yard, for manufactured material, for miscellaneous supplies, and so on. These books are given to the foremen in charge of stores in the respective departments. It is not necessary to wait for the day to commence taking the inventory. As a general rule, we commence from two to three weeks ahead weighing, measuring and counting such material as can thus be handled. In this way we distribute the work. A good portion of the iron on hand may be weighed and marked in advance. On the day appointed for the inventory, the balance of material (*i. e.*, that not already ascertained) is added to the portion already summed up. Two or three days in advance men are detailed so that each storehouse foreman will have the use of as many clerks as necessary; each clerk has two or three laborers.* The work is

* If possible, skilled laborers should be selected to assist the clerks in taking the inventory. In the event the force employed by the storekeeper is not sufficient, he should make requisition upon the operating officer immediately in charge for such assistance as he needs. Men thus assigned should act continuously until the work is completed.

divided so that each man has a portion assigned him. On the appointed morning every man is at his post, provided with blocks of paper, pencils, scales, etc. They commence at one end of the storehouse and go through, making a record of everything in turn. As soon as an article has been recorded, it is marked with a cross to indicate it has been inventoried. The foremen of the divisions follow the men and gather up the records. These they take to the office and examine. The items are then posted in the journal referred to. Lumber, scrap and outside material is inven-

Carriage in England — First Railway Coach.

toried in the same way. Manufactured material is the most difficult, as it is scattered through the various shops; we keep a record of such material when it goes into the shop, noting when it is returned; we use this in taking the inventory; with it we figure prices, including labor, up to the time of taking the inventory. At the close of the day all material has been inventoried. Weights and measures are afterward determined, articles recapitulated, prices inserted, and the total stated. The contents of the journal are then drawn off on the inventory blanks and the latter footed and copied."

Another storekeeper says:

"I commence with some article in one corner of the storeroom, take screws, for instance, beginning with the lowest number, and count the number of that size, and so on to the largest size, entering the price of each different size as well as number, and so continue through all the material on hand, giving number, quality, or pounds, as the case may be."

The foregoing plans may be generally followed to advantage. However, instead of taking the inventory on blocks and loose slips of paper, afterward entering it in the journal, a better plan is to use the stock books; to use these books directly. Each section or department of a storehouse or yard should have a separate stock book. The person taking the inventory notes the articles on hand in the book. From these books the inventory sent to headquarters is made. It is practically necessary to take an inventory monthly as it is impossible to make a requisition intelligently for needed supplies without such information. The stock book should have a column for articles and twelve columns for amounts, one for each month.

When an inventory is to be taken by an inexperienced person at isolated shops or elsewhere, a competent man should be sent to assist in the work. As a rule, however, if a printed list of the articles to be inventoried is furnished, the quantities on hand may be set down opposite, and the prices and totals left to be inserted afterward at headquarters.

In taking an inventory, the storekeeper should commence at an initial point and follow up the work in due order, taking all classes of material as they come. Only by such a course can omissions be prevented.

The description of articles as entered on the inventory should be full, so as to permit the insertion of prices afterward. Any exceptional circumstance connected with an article, such as that it is worn, broken, worthless, or not needed, should be noted for the information of those concerned.

The difficulty of determining prices is enhanced when the cost of transportation is added to values. If, however, intelligence has been exercised in recording charges for transportation, it will not be difficult to determine the amount to be added to each article on such account. The necessity of adding such charges must not, however, be lost sight of, as any omission to include them will magnify the difference between the value of supplies on hand as shown by the inventory and the amount as charged on the general books.

In reference to transportation charges on supplies, practices vary. In some instances, companies charge for transporting over their own road. As a rule, however, this is not the custom, the only charges recognized as proper being those over other lines.

It is highly desirable that the practices of carriers in reference to charging for transporting operating material over their own lines should

be uniform, so that in judging of the relation expenses bear to earnings the basis may be understood. When local charges are added for transporting supplies, the effect, of course, is to increase the earnings by that amount, the charge being added to cost of material, an asset; afterward it is transferred, when the material is used, to an expense account. The effect is not uniform on different roads, being dependent upon length of haul, rate charged, etc. While the practice of charging for transporting operating material is not generally followed, it is eminently proper in the case of construction supplies. But practices differ here again; some companies charge tariff rates, while others charge only the cost of service. Some companies, moreover, charge on all kinds of construction material, while others charge only on that which enters into new lines. Whatever the practice may be, a company is clearly entitled to charge tariff rates on construction material, without reference to whether it is to be used on new lines or on old ones.

As already stated, articles should be inventoried at current prices. If the article is one that has been included in a previous inventory, the price then charged must not govern, unless in harmony with current prices.

Prices for articles to be inventoried should be furnished storekeepers in advance. This will be possible except for articles manufactured by a company; in the latter case, cost of manufacture

should govern. Except in regard to such articles, storekeepers should not attempt unaided to determine the price of material.

Prices should be fixed by some central official conversant with the facts, so that they may be authoritative and uniform. Net prices should be furnished, *i. e.*, the price to be charged when the material is taken from store for use.

The prices at which articles are inventoried are intended to govern afterward.

Carriage in France, A. D. 1859.

Labor may be saved in taking the inventory if the precaution has been observed in advance to note on large castings and similar material the weight or quantity thereof. This will enable the storekeeper to ascertain the quantity at a glance.

Material on hand at the time of taking the inventory not charged to the storekeeper should, of course, be omitted.

One embarrassment in taking an inventory is to determine whether material just received or in

transit is charged within the time covered by the inventory, or subsequent thereto. A separate inventory of such material should be taken pending definite information. Afterward, it should be embodied in the general inventory or not, as the case requires.

Another embarrassment is occasioned by the disbursement of material while the work is going on. This difficulty will be lessened if a mark is put on each article or class of material as it is inventoried, as a guide to disbursing clerks and others. It will enable them to determine at a glance whether to charge the material as disbursed prior or subsequent to the inventory.

So far as possible receipts, shipments and disbursements of material should be held in abeyance while taking the inventory.*

In arranging for the inventory, it should be apportioned in advance, and assigned to those expected to perform the work, so as to prevent omissions and duplications.

The inventory should be certified to by the storekeeper in charge, and sent forward at the time stated. Articles should be entered in alphabetical order. A special blank may be used to advantage.

Attached to, and accompanying the inventory, should be a summary showing the aggregate

*The form used in taking the inventory, also many particulars referring to the work, are embodied in volume "Fiscal Affairs, Disbursements."

amount of each class of material and the value thereof.*

A separate inventory should be made for material not fit for use, including scrap; the total amount of this inventory should be embraced in the general inventory; also in the summary thereof.

If, for any reason, it is impossible to ascertain the actual quantity of any kind of material, a careful estimate of the same must be made, noting the fact on the inventory.

A separate inventory should be rendered for coal and wood. One inventory may embrace both; the former being entered first, the other afterward, a summary of the two being appended.

Such further classification of the inventory may be made as the wants of those in charge suggest. Thus, when separate operating accounts are kept for rails and ties, it is well to require a separate inventory for ties and rails, so that the storekeeper may determine the amount of the excess or deficit for those items separate from other track material. In such cases, the general accounting officer should be advised, so that he may make the general books of the company conform to the facts.

*I have known the material of a company to be divided in this manner under thirty-four heads for the purpose of better satisfying stockholders and others.

CHAPTER XXI.

PRACTICES AND METHODS IN REGARD TO CHARGING FOR THE TRANSPORTATION OF MATERIAL AND EMPLOYES.

The bulk of the supplies used by a company must be transported by it for a greater or less distance over its own line. Very little material is delivered at the point where it is required for use.

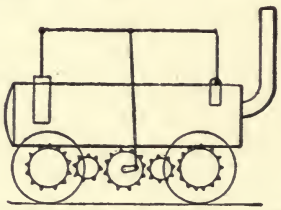
The number of miles supplies must be hauled will vary. The average will never be the same upon any two lines. Consequently the expense will never be the same. Circumstances dictate the place of purchase. One company will be able to buy ties in the neighborhood where needed, another will have to buy at a distance; one company will be able to procure its fuel along its line, another will have to move it further; one company will be able to buy lumber and timber near where needed, another will have to seek them at a distance.

The supplies of greatest bulk that must be transported for a greater or less distance are fuel, ballast, rails, ties, machinery, rolling stock and material for bridges, buildings, fences, platforms, etc.

The quantity of material to be transported depends somewhat upon its durability. This de-

pends upon climate, quality, the use to which it is put and the care taken. Poor rails must be renewed oftener than those that are good, and a track subjected to the wear and tear of a heavy traffic must be renewed oftener than a track not subjected to such a strain.

Climate and soil have much to do with durability. Wood will not last as long in a hot climate as in a cold climate, and ties embedded in a damp soil will require to be renewed more frequently than in dry soil. The more frequently the renewal the greater the quantity of supplies to be



Locomotive "Puffing Billy," A. D. 1813.

transported; the greater the expense. The interest attaching to the subject is heightend by the practice of charging for hauling supplies.

I do not know where it originated. I know, however, that while the custom is not general, its advocates are sufficiently high in authority to have secured its adoption by many important and well managed lines. The very conservative railway commission of Massachusetts (an authority the railway commissioners of other states defer to in many things) in 1878 directed that fuel and material (except gravel) hauled for a com-

pany's use, should be credited to freight earnings at fourth class rates and should be charged to the proper accounts, and included in the tonnage.* A practice having such backing can not be passed over lightly. I can only notice its more salient features.

The practical effect of charging for the carriage of supplies is to increase the nominal earnings of a railroad and to enhance correspondingly the price of every article used, thus swelling the expense account. The rate charged is incorporated at once with the freight receipts of the line, and added to the cost of supplies on hand. When the supplies are used, the gross cost is charged to the account the material is expended upon. But until the material is used the supplies appear in the accounts as an asset. So that the effect is to swell the income and increase the assets by a like amount. Thus apparently conferring a double benefit.

When supplies are used, operating expense and other disbursement accounts are debited, and thus, finally, the gain to income is set off by a charge. But the latter, unfortunately, never appears in the accounts simultaneously with the gain. Months may intervene.

A company must always keep on hand a large quantity of material. Whatever the amount is, the local earnings thereon appear as an asset, whereas they are really an expense. The accounts

* Eighth annual report of Board of Railroad Commissioners, Mass., p. 87.

are thus misleading. A fictitious asset, dependent upon the amount of supplies a company uses, the distance they are hauled and the rate charged, is made to do duty as so much property, while legitimate operating expenses are shrunken by a corresponding amount.

When the earnings of a company are increased by charges on its own material, it is necessary to swell the tonnage correspondingly. Thus, commercial operations are magnified and distorted. Moreover, if the rate at which material is carried is fixed at a low price, as in Massachusetts, it lessens in the returns the average rate, generally, the company receives for doing its paying business. Thus further misleading.

If the practice of charging for the transportation of material were universal, the harm would be lessened somewhat because generally understood. Until it becomes general or is abandoned, the amounts that thus accrue should be stated separately in the returns for the information of owners and investors.

Other objections to the practice suggest themselves. Charging for the carriage of material adds to the cost of accounting. It magnifies details. Thus, material must be weighed at the freight house and the charge extended. When it reaches its destination the charge can not be paid in cash as in other cases. Before the accounts of the agent can be relieved the charge must be formally examined and passed upon by the accounting officers and a voucher made and

audited. The earnings upon the material must also be systematically followed up and recorded at headquarters and at the storehouses, so that they may be disposed of when the material is finally used. This involves clerical work and increases the force, besides adding other expenses.

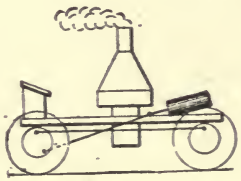
If the practice of charging for the carriage of supplies is to be incorporated in railway practice, it is clear that a fixed rate should not be charged for all kinds of material. Cost varies. Moreover, uniformity is repugnant to established practices, and is demoralizing and misleading. Charges should be based on the ordinary tariffs of a company. They are the product of men skilled in the subject. Although crude in many respects, they exhibit infinite labor, and are the result of acute observation and thought.

While the transportation problem is a science still imperfectly understood, we are sufficiently versed in its mysteries to know that an arbitrary rate is a commercial impossibility.

Moreover, if it is right to charge for wood, coal, stone, ties, iron, fencing, and other material, as the Massachusetts commissioners suggest, why should ballast be excepted? The latter is an indispensable article and one of great importance, and exceedingly costly to handle. Its omission is clearly not justified. Its incorporation as earnings with other material, at fourth class rates, would quadruple the receipts of many lines. But whatever the increase might be, any

benefit arising from the practice would be more than counterbalanced by increased cost of stationery, accounting, etc. It would also still further destroy the relation that operating expenses bear to earnings, making the former in many cases more than the latter.

The subject is prolific of suggestions. If it is right for a company to charge for transporting its material, then it is clearly right to charge for the carriage of its employes. It is not only right but necessary. The employe handles the supplies; without him they are valueless.



Locomotive "Best Friend," A. D. 1830.

The charge for transporting material is made for the purpose of ascertaining outlay at the point of use, so that we may know the total cost of a structure or thing.

But if the principle is right, why stop with material? To make the information complete we must also include the cost of transporting the operative who uses the material.

To charge for the transportation of employes would greatly increase passenger receipts. It would swell correspondingly the disbursement items affected.

The cost of keeping account of the movements of operatives and the debits and credits resulting therefrom would be considerable, but not greater relatively than for material. The two would warrant the formation of a special bureau of accounts.

Under a system of charging for supplies and operatives, earnings would no longer indicate profits or be dependent upon cash collections. They would depend upon the quality of a company's material, its durability, where it was purchased, the industry and enterprise exercised in moving it from point to point, the number of employes and, finally, the celerity with which the latter traveled from place to place. All that would be necessary when times were dull and receipts light, or when it was desirable to exhibit large earnings, would be to load half a dozen or more trains with operatives or supplies and haul them such distance as might be necessary to make up the volume required. Such a system would be popular with receivers who get a percentage of earnings for their services!

But seriously, the fictitious element which the practice of charging for the transportation of supplies and operatives injects into the accounts of a railroad renders it unadvisable, even if it did not increase expenses. Under it railway reports would no longer be trustworthy. We should ever be in doubt as to what was real, what was fictitious; how much of the property was *bona fide*, how much assumed. Our examination would resemble our examination of Jupiter

—we should be forever striving to ascertain how much was solid, how much gaseous.

In many states taxes are based upon gross earnings; to charge for the transportation of supplies and men would add to the embarrassments of the subject, a subject already too complicated.

In conclusion I may say I can not enumerate the number and serious character of the objections that suggest themselves to me in connection with the practice of charging for transporting supplies and men. I have said enough, however, to cause those who are interested to give the matter careful investigation before coming to a final decision regarding it.

What I have said, however, it should be understood, does not apply to construction material, or men engaged upon construction work. In the opening of new lines and for additions, equipment and work properly coming under the head of construction, it is important that the whole cost should be known. Hence, it is not only proper but necessary that a charge should be made for material and men carried in connection therewith.

Operating expenses are of an evanescent nature. Construction is something permanent. Upon the latter owners are entitled to a return forever. Hence the necessity of knowing the full amount. Other reasons suggest themselves why it is desirable that the exact cost of construction work should be known. However, each company should, I think, be left free to act in the matter as it thinks fit.

CHAPTER XXII.

INFINITE NUMBER OF ARTICLES USED BY RAILWAYS—ECONOMICAL VERSUS EXTRAVAGANT GOODS.

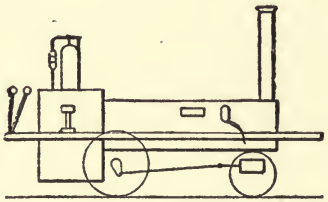
A description of the articles consumed in the operations of a railway would embrace substantially every class of material known to the world of trade. This statement will seem like an exaggeration to those who are accustomed to look upon the track and completed train as embracing practically all there is of a property. It is, however, substantially true.

Many of our railroad companies are large manufacturers. They purchase the raw material in the market, and use it as they require. Thus they procure copper and tin in ingots, and from these make the brass journal bearing used upon their engines and cars. From the scrap collected along the line, or purchased in the market, they manufacture axles for cars. The articles of tinware used by them they are frequently able to manufacture at a profit over dealers' prices. Many of the fixtures and much of the furniture used in their offices and buildings they manufacture.

Some companies construct and furnish their own buildings, build their own equipment, repair the rails in their tracks and manufacture the car

wheels and castings they require. They make and erect their own bridges, mine their own coal, cut their own wood, build their own fences, construct their own telegraph lines, manufacture their own paints and in fact perform all the functions of manufacturers on a varied and extended scale.

The repair and maintenance of railway property require constant outlay. Everything belonging to a railway company deteriorates unless carefully looked after. Many companies, while



Locomotive "Old Ironsides," A. D. 1832.

they are unable or deem it inexpedient to enter the field as manufacturers, nevertheless perform the work of repairing and maintaining their property. Thus, while they will not construct a locomotive, yet when once it is their possession, they attend to its preservation and renewal.

Supplies are required by railways for three purposes, construction, maintenance and current operations. It is impossible to enumerate the articles. They embrace every species of material, from building stock to the ink used in transcribing the accounts.

All the articles of merchandise that find a place in warehouses or on the counters of our stores are more or less in demand by railroads. Their purchase interests all kinds of producers; every species of industry. The jeweler finds in railway companies consumers for his chronometers.* Each station and ticket office must be supplied with accurate timepieces. Jewelers discover in employes trustworthy and never failing customers for their watches. The vendors of diamonds find in railroad companies a market for their wares.† They are also steady and profitable customers of the gold beater.‡ A railway is a large consumer of silver and nickle, which it uses for plating lamps, window and door fastenings and the interior decoration of its cars. It uses bronze for gilding in its offices and upon its equipment. Its bells, car and switch locks, steam fittings and journal bearings are made of brass. It uses copper for the manufacture of flues and injector pipes.

It uses great quantities of tin for solder and the construction of buildings, rolling stock, oil reservoirs, cans and lamps.

It buys lead in pig, in sheets, in pipes, and ceruse.

It consumes babbit metal, and requires, in its operations, cadmium, zinc, mercury and platinum.

* These are used for regulating the watches of conductors, agents and others.

† They are used by glaziers, miners, etc.

‡ The gold is used in ornamenting the panels and headlinings of passenger coaches, in lettering and sparingly in adorning the company's offices.

Its track is made of steel and iron. They also form an important element in the construction and maintenance of locomotive boilers, cross-heads, tires, crankpins, smokestacks and tender springs, bridges, track connections, frogs, tools and other implements.

The number of articles in which steel and iron enter is as great, proportionately, upon a railroad, as in other enterprises. They outrank all other kinds of metal. A railway is a liberal purchaser of merchant iron and steel. It uses these metals in connection with wheels for locomotives and cars, steam cylinders, steam chests, furnace grates, brake shoes, drawbars, switches, bridges, trestles, axles, bolts, shafting, turntables, trucks, engine boilers, tanks, flues, smokestacks, stoves, pipes, and other objects.

In attempting to enumerate the articles used by a railroad, we find the most considerable number under the head of hardware. Its use for this class of material embraces substantially all the articles to be found in stores devoted to the sale of such goods. Under this head are many curious things; thus, railways use over one hundred different kinds of files, each having a separate designation and purpose in the economy of shop work. They use over four hundred different kinds of screws, one hundred and fifty different kinds of rivets, seventy-five different kinds of augers, a like number of locks, a hundred different kinds of bolts, and so on.

Under the head of hardware railways use pitch-

forks, garden rakes, spirit levels, closet hooks, oil stones, pincers, matchsafes, nails, spikes, files, keys, hooks, axes, anvils, hinges, bolts, tools for carpenters and machinists, springs, trimmings for houses and cars, grindstones, handles, and all the multitudinous articles to be found in a hardware shop.

Turning to another branch of the service, a railroad requires wagons and horses for the active and economical conduct of its business. The disbursements on this account are exceedingly varied, extending from an ordinary cart to a closed carriage, and involving, directly or incidentally, all the paraphernalia of the wagon and harness maker.

A railway company uses everything that a stationer has for sale — journals, ledgers, letter-presses, paper, blanks, forms, pencils, pens, inks, erasers, weights, and other articles of the counting house.

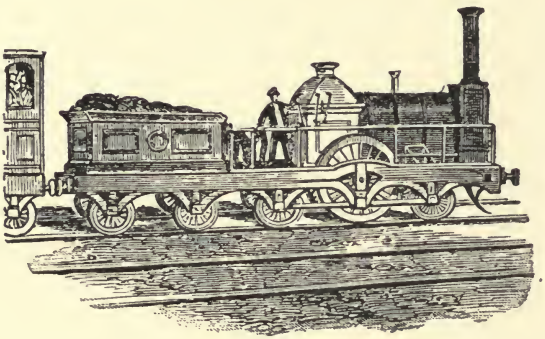
It requires for its engineering corps transits, levels, compasses, drafting instruments, chains, tape lines, leveling rods, ruling pens, barometers, stencils, and the accessories thereto. Its laboratory contains every useful scientific appliance.

The disbursements of a railway are not confined to articles of plebeian use. Coaches and sleeping cars glisten with rosewood and walnut; they are adorned with resplendent mirrors, rich upholstery and brilliant curtains of satin and gold. Rare Indian rugs and costly carpets cover their floors. In the offices and waiting rooms

and upon the common cars are furnishings but little less costly.

The varied necessities of railroads make them liberal patrons of dry goods and jobbing houses; thus, they require cloths and linens of various kinds in the manufacture of bedding, car cushions, linings, curtains and for other uses.

They use wood in vast quantities. No other enterprise compares with them in this. Many



English Switch Engine, A. D. 1849.

great companies still use wood on their locomotives. Until the introduction of metal structures, fences in the United States were constructed wholly of wood. Their ties are still manufactured almost wholly of wood. Their buildings and other structures are also constructed largely of the same material.

In some instances little regard is paid to the quality of the material purchased. Thus, light and soft woods are sought in preference to those

of a more durable character, not because they are more economical, but because they can be bought for less.

All the higher grades of wood are used by a railroad: oak for frames and sills; rosewood, walnut, maple and cherry for the interior of cars, coaches and offices; hickory for the handles of tools; ash for track gauges, and so on.

Railways vie with the merchant marine in the purchase of hemp, manilla and wire rope for their depots, shops, trains and wrecking cars.

They are vast consumers of oil for lubricating and cleaning their equipment and machinery; for mixing their paints and for lighting purposes.

They use glue and other adhesives in connection with their equipment, buildings and furniture.

They require for cleansing and polishing, emery, emery cloth, emery wheels, kriolite, oils, acids, waste and other substances.

They use rubber for air brakes, steam heating purposes and many other purposes.

They are consumers of stone, brick, lime, cement and asphaltum.

Their hotel cars, eating houses and lunch rooms require for their operation all the varied necessities of a public house; they need the furniture peculiar to hotels and restaurants. They must be stocked with tobacco and cigars, and with native and foreign wines; tender and juicy meats; rare game; rich sauces; pungent spices; salmon from the Columbia; blue fish from the

great South Bay; trout from the cold waters of Mackinaw; breadstuffs; succulent vegetables and delicate fruits.

In the operation of the telegraph, telephone and other electrical appliances, railroads consume large quantities of material peculiar to these undertakings; plain and insulated wires; poles upon which to string them; cables; vitriol; acids; mercury; platinum; zinc; magnets; relays; sounders; registers; insulators; switches, and so on.

The successful and economical operation of a railroad requires it to make use of every appliance whereby time and expense may be saved. Thus, it employs the telegraph, telephone, papyrograph, electric pen, hektograph, lithogram, typewriter, etc. It uses the best machinery; the latest appliances.

For the working of its quarries and mines it requires the tools and appliances peculiar to such industries; also powder, nitroglycerine, and other explosives employed.

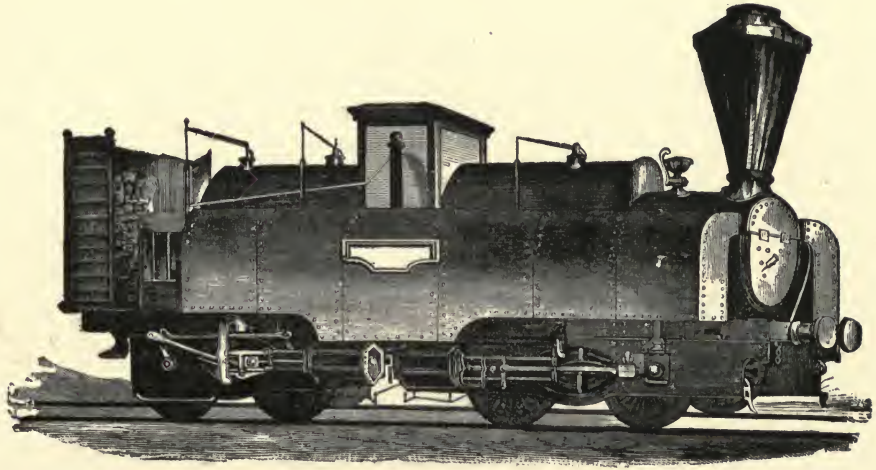
For the protection of its pay cars and officers it possesses the most approved pattern of firearms and explosives.

In preserving and adorning its buildings, bridges and equipment, and in connection with its signals, machinery and tools, it is a constant consumer of all kinds of paints, oils, varnishes, and like substances.

In connection with the construction, repair and maintenance of its furniture, bedding, car-

pets, matting, cushions, curtains, etc., it requires needles, thread, thimbles, beeswax, hooks and eyes, pins, buttons, etc. It keeps in its storehouses photographic appliances, fans, silver pearl rouge, rat poison, washing powder, sulphur, soap, toweling, mirrors, dust pans, mouse traps, black manganese, molasses, torpedoes, stove polish, salt, candles, nippers, bung borers, garden rakes, hoes, porcelain wash bowls, wheat, bran, mops, brooms, baskets, sprinkling cans, calfskin, webbing, gimp, curled hair, napkins, blankets, mattresses, table cloths, counterpanes, tea, coffee, sugar, beans, rags, slates, slate pencils, candles, filters, fire extinguishers, bunting, canton flannel, prepared chalk, soda, sal ammoniac, sieves, chamois skins, libraries, Bible racks, pumice stone, cotton cloth, carpet tacks, antimony, plumbago, rotten stone, tripoli, mica, seagrass lines, windmills, tents, maps, atlases, directories, counterfeit detectors, mail bags, carpet sacks, trunks, and many other things that no one would expect to find.

It is apparent from the foregoing that the material of a railway comprehends an infinite number of things. I have not attempted to enumerate them; merely to point out some of the more varied and prominent articles by way of illustration.



German Locomotive (Water Tanks at Side), A. D. 1850.

CHAPTER XXIII.

PERMANENT MATERIAL AND STRUCTURES—INCIDENTS OF RAILWAY LIFE AND EXPERIENCE.

Much of the material used in the construction of railways is indestructible. Ages hence it will be found in its present shape. This is especially so in regard to the foundations of bridges and buildings; also with more or less of the roadway. These are the features that have come down to us from antiquity; have preserved to us the methods of the ancients. Thus, the highways constructed by Rome in the plenitude of her power remain today substantially as she built them. This is true also of the foundations of many of her great structures. But the magnificent tombs, rich in marble and statuary, wherein she laid her dead, have long since been torn down and rifled. The palaces where her people lived, the temples in which they worshipped, her public buildings and playhouses have crumbled into dust. The monuments erected by her in commemoration of her triumphs, and intended to carry down to the latest generations of mankind the story of her greatness, lie broken and discolored beneath the accumulated debris. History recalls her magnificence, her wealth and barbaric splendor. But

her highways alone remain to tell their own story. Along these we may yet trace the march of her armies, the route of the vast caravans that supplied her with food.*

The great roads of antiquity are no longer things of current use. Once the focus of bustling life and commercial activity, they have shrunken into cow paths and grass grown avenues—the play grounds of children. They no longer possess more than a neighborhood importance. In their place we have the railway; the creature of today, permeating every nook and crevice of industry and profit, it wraps the globe in its iron embrace.

Two thousand years from now, when the railway has, in its turn, given place to something better, or when in the evolutions of time, civilization has again lapsed into barbarism, the habitant of that distant day will view with wonder and awe the countless roadways and viaducts of the nineteenth century. He will trace these arteries of civilization in every quarter of the globe and in every field, over deep morasses, across trackless deserts, through im-

*The famous Appian Way is buried by the accumulated dust of ages, some feet under ground. Portions of it have been opened and exposed to view. It was paved with hard trap or porphyritic rocks of irregular or accidental dimensions; they have a flat surface and looked like and may have been cracked boulders from the bed of the Tiber. Some of them were more than a foot in diameter. These were laid first and the interstices were filled in with smaller stones, so that the joints were broken in all directions.

penetrable jungles, darkened tunnels and rugged cañons, by pathways cut in the solid rock; over foaming torrents and towering mountains. He will find no spot too high, no place too deep, no chasm too wide.

The railroads that lie like countless seams upon the face of the earth, with each year's use take deeper root, become with each succeeding train more indissolubly blended. Who can foretell their future, who estimate their effect upon mankind? Radiating like scientillations of light, they promise to become general in presence and usefulness.

We cannot compare the few great highways of Rome with the railroads of today. The former were indestructible. Ours promise to become equally so. Rome built of imperishable stone. Our process is more simple, more economical. We force the material we need, by slow and imperceptible processes, deep into the earth, piling broken rock and enduring gravel layer upon layer until a roadbed is secured, dry, elastic and indestructible.

The process is interesting.

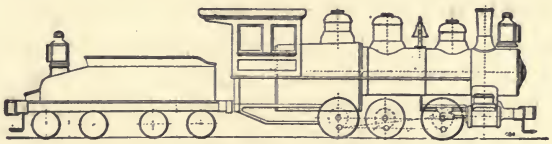
An embankment is first thrown up. The inequality of the ground sometimes requires that it should be higher, sometimes lower. In a flat country it is only a few inches in height. It answers several purposes; it drains the track; admits of easy gradients, a level surface and holds the tie in place. Upon this embankment the sleepers are laid. Upon them the rails are placed.

To secure requisite firmness, the ties are imbedded in the ballast. Now, common soil, rich in productive capacity, is too compact to make a good roadbed. It is not sufficiently porous. It retains moisture. It holds the tie as in a basin. The impingment of the train causes the surface of this basin to harden. Water lies in it as in a cup. The tie absorbs the water and, absorbing it, rots. But what is quite as important, the track is heavy; its cohesiveness is quickly destroyed. It does not possess sufficient power to withstand the weight of the tiain, and so is swallowed up as in a bed of quicksand. The defect is fatal, except upon roads little used. To obviate it, broken stone, coarse gravel, cinders, even sand, are employed to buoy up and ballast the track. It is spread in layers over the whole surface of the roadbed. It slopes outward from the center, where it sometimes reaches two or three inches above the tie. It is forced underneath and about the tie. For this purpose thin, wedge shaped tamping bars made of iron or steel are used. The water quickly filters through the ballast, leaving the track dry, compact, elastic. But while this is important, it is quite as important that the bed upon which the ballast rests should also be freed from water. To permit this the embankment upon which the ballast is placed is so high that the water seeps out at the sides and is carried away in ditches or drains.

The ballast I have described possesses little more elasticity than common black soil or loam,

but it is not so compact. Broken stone, perhaps, makes the best ballast. Next comes coarse gravel and cinders. Fine gravel and sand do not possess sufficient body to hold the ties; moreover, they create dust. This dust envelopes the locomotive, fills the cars, permeates the machinery, and finds its way into the journal bearings of the train, cutting and destroying them like millions of revolving diamonds.

The action of frost upon a track is peculiar. When the ground freezes, the roadbed and its adjuncts are forced upward. Not uniformly, but



Locomotive, A. D. 1894.

in some places more than in others. When the frost disappears, the bed recedes, but as it recedes the ties become loosened and remain nearer the surface. The track is irregular. To remedy these defects it is necessary from time to time to add new ballast, to tamp it around the tie and level the surface as in the first instance. A roadbed thus constructed becomes in time practically impervious to water and so raised above the surrounding earth as to be quickly drained. There being nothing to freeze, it is not affected by frost.

Such a track is as indestructible as the earth in which it is imbedded, and so long as the world

revolves, and the action of heat and cold are the same as today, it will remain an imperishable monument of our time.

Everything connected with railroads is still in process of evolution. Early experience gave slight indication of their perfected methods and universal use.*

The discoveries of today in railway appliances are discarded tomorrow. Such is our progress.

The principles governing the business of railroads are only beginning to be generally understood. The laws of political economy, when applied to their affairs, have been looked upon as encroachments, and necessary police regulations have been viewed with suspicion. Classes have sought to confiscate their rights under guise of regulating their affairs, while adroit politicians have made them the stepping stone to ambitions purely personal.

The creation of yesterday, railroads possess neither history nor prestige. A necessity to the

* Thus, to cite a few instances among many, the first railroad of South Carolina ran only one train a day. At other times the engineer, upon application, made excursions into the country for a consideration. Among its regulations was one that dogs might be admitted to passenger cars if travelers did not object; another that firearms should be discharged before the person carrying them entered the cars; another that no way bill should be made for less than six and one-half cents. The doors of freight cars were in the end. One day the boiler exploded because of the fireman holding down the valve to prevent annoyance from escaping steam. Afterward a flat car loaded with cotton was placed between the passenger cars and the engine to protect the passengers. When a train was behind time, the people in the towns were notified of its approach by the display of a flag from the church steeple.

community, they have been made the plaything of legislatures. No traditions endear them to the people. Giants in strength, a Liliputian is sufficient to hold them in check. The spirit that animates them is but little understood.

The extent of a railway company's power is unknown and, like everything unknown, it is feared. It was necessary to the accomplishment of political ends that this fear should in certain sections be cultivated. It turned into hate. Adventurers made use of it. That their depredations have not been more general, we owe to the good sense of mankind.

The beneficent aims which railroads serve will in time rescue them from those who seek to use them for purposes of political aggrandizement.

If, as I have shown, a railway is sometimes the cause of much unnecessary apprehension, it is also sometimes the occasion of much genuine pleasure. This is so in the case of those so fortunate as to participate in its hospitalities.

What attention can there be more insidious than that of a great corporation? It adds much to such hospitality that it is of rare occurrence. Enjoyments that are seldom participated in are held in especial favor.

Those who have been the guests of railway companies never forget its pleasant memories. No one, not even a veteran railway manager, can wholly withstand the circumstance and pomp of a special train. Its delights, its excitement, its animation, its social enjoyments, its luxurious

cars and attentive waiters, are things that do not pass from the memory. Long afterward they are recalled with delight. We remember every incident; the waiting crowds at the stations, as the train plunged past with a rush and a roar, that made the dead leaves and bits of paper dance and skip like boys playing leap frog; the staid old switchmen, standing at their posts as the train flew by; the sunburnt faces and old fashioned costumes of the trackmen; the bustle of trainmen, waiting on the sidings, the engineer leaning out of his cab, the fireman standing by, the conductor signaling to go ahead, the trains slowly pulling out as we disappear in the distance. Nor do we forget the officials on board. They were, in all things, attentive and kind. We shall remember forever the look of settled gloom with which some of them regarded the track from the rear car; how intently they gazed backward at the bridges, as if they expected to see them detach themselves from their fastenings and set out in hot pursuit of the flying train. Again we watch them as they point with languid interest at the growing crops; hear them talk in monosyllables of the coming avalanche of business. This anticipated crash, we remember, caused them to shrug their shoulders, to laugh lightly, as if it were more than probable that they would be crushed under its weight. We remember the look of settled melancholy upon the faces of some as they passed through the cars, a look of responsibility that hinted darkly at impending

dangers; a look such as an old captain might wear upon a stormy night on some unknown coast. We remember the many secret conferences they held in unfrequented parts of the car; the reams of paper that were consumed in communications afterward destroyed; the mysterious communications a junior official wildly flung from the train as stations were reached and passed. We remember the abruptness with which certain officials addressed those subordinate to them, and how deferentially they approached those above them. We remember the careworn expression and look of anxiety upon the faces of the younger officers, as if they would like to get away from their superiors for awhile and have a quiet time in the baggage car. And the conductor! He whom we had all our lives seen coming and going with stately freedom, where was he? We found him, toward night, in a disheveled condition, on the engine, talking in a disjointed way with the engineer. More fortunate than the youngsters on board, he had a place of refuge. The incidents were many and varied. I remember particularly that whenever we stopped to take fuel or water, one high official, with large hands and legs of great strength and thickness, rushed wildly into the depot, looked hastily around with clouded brow and lowering eye, and then as hurriedly returned to the train. Other officials meanwhile carefully scanned the waterhouse and fuel sheds as if they thought seriously of taking them down then and there.

We can not tell half the many delightful things we saw. But we love to remember them and grow garrulous over them on occasion. All of us have been upon at least one excursion, or, if not, some dear friend, more fortunate than we, has described its every detail, not forgetting what the great officials said to him, and what he said in reply.

One of the notable things connected with a railroad is its business car. This vehicle is at once a drawing room, boudoir, dining room and kitchen—a domestic establishment on wheels. It is a necessity on every railway. It is the manager's home. He spends weeks at a time on the road looking after business and inspecting the property. To the world at large these journeys are delightful excursions, but to him they are dull and uneventful. However, certain state attends them. The progress is swift or slow, direct or circumscribed, as circumstances require. They are restful. After weeks of dull, monotonous office work the pure air and quiet of the country are invigorating. The usefulness of railway managers is greatly prolonged by these journeys. Their business car is their fortress. In it they escape the importunities of the greedy and the drudgery of detail. It is as snug and cozy as a lady's boudoir. Its easy chairs suggest comfort and a good cigar after dinner. A cozy table in the center hints at whist, when the car is whirling through the country, or is laid up for the night in some quiet town. Railway managers do

not travel alone; they go in groups. Each inquires into the needs of his department. In this way they are kept advised of the wants of patrons and the needs of the company. After a trip they return to their desks refreshed; many important matters have been attended to; business has been accelerated; they have become better acquainted with the property, and their ability to work has been increased by what they have seen and heard.

APPENDIX.

FORM 1.
(Size 8½x7¼ in.)

REQUISITION FOR MATERIAL.

_____ 18

_____ *No.* _____

_____

Dear Sir:

REQUISITION *is hereby made for* **MATERIAL** *called for below. Please send without delay to* _____ *at* _____

and send the invoice to _____ *at* _____

(363) NOTE.—In the event the material asked for is not granted, or the quantity is changed, or the purchase delayed, immediate notice of the fact will be sent to the person making the requisition, so that he may act intelligently.

Signed, _____

Approved, _____

QUANTITY OF MATERIAL.			KIND OF MATERIAL.	REMARKS.
Now on hand.	Not yet rece'd on previous requisitions.	Additional quantity wanted.		

FORM 2.
(Size 7½x6 in.)

ORDER ON STOREKEEPER FOR SUPPLIES.

*To Storekeeper at*_____ _____ *18*

*Dear Sir:—Please deliver to*_____

*at*_____ *without delay, articles as specified below:*

PLEASE NOTE THOSE RETURNED, AND ACKNOWLEDGE RECEIPT THEREOF.

Quantity on hand.	Quantity returned.*	DESCRIPTION OF ARTICLES.	Quantity hereby ordered.
Charge to			

*These articles were returned

_____ *18*

_____ *Car No.*_____ *Signature,*_____

NOTE.—The form used in ordering brasses is similar to the above, except that the names of the different kinds of brasses are printed in order, in the column headed "Description of Articles."

FORM 3.

DINING CAR CONDUCTOR'S ORDER.

Supplies for Car.....

From.....

To.....*and return.*

Date,.....*189*.....

Approved,.....

Articles on Hand From Last Trip.	ARTICLES.	ORDER.	
		Articles Hereby Ordered.	Articles Actually Furnished on This Order.
	Bacon,		
	Chickens,		
	Oysters,		
	Apples,		
	Etc.		

FORM 4.

DINING CAR CONDUCTOR'S REPORT.

Dining Car Conductor's report of supplies on hand from last trip, furnished by storekeeper, purchased on road, on hand at end of trip, and quantity and value of supplies consumed.

Car.....

From .....

To.....*and return.*

Date,.....*189*.....

Articles Ordered.	ARTICLES.	Articles on Hand from Last Trip.	Articles Actually Furnished.	Articles Purchased on Trip.	Total Quantity of Material on Hand	On Hand at End of this Trip.	Amount Consumed on Trip.		Money Value of Supplies Consumed.
.....	Bacon, ...	.....	.....	.....	.....	.....	.....	.....	.....
.....	Chickens, ...	.....	.....	.....	.....	.....	.....	.....	.....
.....	Oysters, ...	.....	.....	.....	.....	.....	.....	.....	.....
.....	Apples, ...	.....	.....	.....	.....	.....	.....	.....	.....
.....	Etc., ...	.....	.....	.....	.....	.....	.....	.....	.....

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